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THE

POPULAR ENCYCLOPEDIA;

OR,

CONVERSATIONS LEXICON.

BEING

A DICTIONARY OF SCIENCE AND ARTS, LITERATURE, BIOGRAPHY, HISTORY, AND GENERAL INFORMATION.

EDITED BY

CHARLES ANNANDALE, M.A.,

EDITOR OF OGILVIE'S IMPERIAL DICTIONARY OF THE ENGLISH LANGUAGE, NEW EDITION.

ILLUSTRATED WITH NUMEROUS ENGRAVINGS.

NEW AND REVISED EDITION, IN FOURTEEN VOLUMES.

VOL. XI.

PETERWARDEIN—RANCÉ.

LONDON:
BLACKIE & SON, OLD BAILEY, E.C.:
GLASGOW AND EDINBURGH.
1884.

399. d. 322.

BODLEIAN LIBRARY
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OXFORD

GLASGOW:
W. G. BLACKIE AND CO., PRINTERS,
VILLAFIELD.

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THE

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PETERWARDEIN, or VARADIN, a town in Hungary, 45 miles north-west of Belgrade. It stands partly on a steep rock and partly on a flat below, and is the strongest fortress on the Danube. Opposite to it is the town of Neusatz, with which it communicates by a bridge of boats. The fortifications are extensive, and contain barracks for a garrison of 10,000 men; but the town itself is very small. It has, however, four churches, a military hospital, an arsenal, a high school; and a trade in wine and fruit. Extensive marshes in the neighbourhood make the air unhealthy. A great victory was gained here (5th August, 1716) over the Turks by Prince Eugene. Peterwardein was occupied by the Hungarians in the civil war of 1848–49. It surrendered to the Austrians 6th September, 1849. Pop. 4022.

PETIOLE, the lower part of a leaf, usually called the *stalk*. When the vessels and fibres of the leaves expand immediately on leaving the stem the petiole is wanting, and the leaf is said to be sessile. In general, however, it is distinctly marked, and is usually either round or half cylindrical, and channelled on the upper side. In the poplar it is strongly flattened at right angles to the blade, and hence the remarkable movement observable on the least breath of wind, especially in the aspen. Sometimes, as in the garden sweet-pea, the petiole is furnished with a kind of border or wing. In many umbelliferous plants its base is dilated into a broad membranous inflated sheath. In grasses and many other indigenous plants it consists of a sheath embracing the stem; in the pea tribe the apex of the petiole is often changed into a tendril. In one section of the genus *Astragalus* it hardens into a spine after the leaflet drops. The petiole in some Australian species of Acacia and Eucalyptus is flattened into a leaf-like expansion, occupying the place of the true leaf; such petioles have received the name of *phyllodia*.

PÉTION DE VILLENEUVE, JERÔME, a French revolutionary statesman, originally an advocate at Chartres, where he was born in 1753, was chosen deputy, by the tiers-état of that city, to the states-general in 1789. In the early part of his career he acted in concert with Mirabeau, but did not join in such of his measures as were calculated to impede the extension of liberty and equality of rights. In October, 1789, he was appointed a member of the first Committee of General Safety, and December 4, 1790, was elected president of the National Assembly. In June following he became president of the criminal tribunal of Paris, and together with Barnave and Latour-Maubourg, was appointed commissioner to attend the return of the monarch. He was elected mayor of Paris November 14, 1791, and in consequence of his implication in the attack on the Tuileries, June 20, 1792, was suspended from his functions, July 6, but restored by the Assembly on the 13th. As head of the Commune he supported the demonstrations of the lower classes, and the arming of the people, and when on 20th June, 1792, the crowds forced their way into the Tuileries, he left Louis for a considerable time to his fate. At 4 o'clock in the afternoon, however, he made his appearance, and by smooth words prevailed on the people to withdraw. When the Marseillese arrived in the capital for the purpose of overturning the throne, Pétion received them like brothers; but before the final storm broke out he went on the 10th August to the Tuileries at the king's desire in order to concert measures of defence. This, however, proved of no avail. His behaviour on the 10th of August has by some been interpreted as the result of weakness, and by others as the effect of design to avoid betraying his character as an abettor of the violence. Being nominated a deputy from the department of Eure and Loire to the Convention, he became the first president of that assembly. Soon after the death of the king Pétion was accused of having contributed to the massacres of September; but against this charge he successfully defended himself. He now, however, became the object of jealousy to Robespierre, and was included in the proscription of the Girondists, May 31, 1793. (See GIRONDISTS.) He made his escape, with some other deputies of the same party, to the department of Calvados, where they in vain endeavoured to avail themselves of the insurrections against the Terrorists. Some time after the body of Pétion, with that of Buzot, one of his confederates, was found in a field in the department of the Gironde half devoured by wolves, and it was supposed that he had perished from hunger. His works were printed in 1793 in four vols. 8vo. His manuscript memoirs were published in 1864. They present no special interest.

PETITION (to Parliament). The right of the subject to petition the king is recognized in the Bill of Rights, and all commitments and prosecutions for such petitioning are declared illegal. By a law of Charles II. (13 Charles II. stat. i. cap. v.), which has been held not to be repealed by the Bill of Rights, the soliciting, labouring, or procuring the putting the hands or consent of above twenty persons to any petition to the king or either house of Parliament, for alterations in church or state, unless by assent of three or more justices of the peace of the county, or a majority of the jury at the grand-jury at the assizes or sessions, and repairing to the king or Parliament to deliver such petition with above the number of ten persons, is subject to a fine of £100 and three months' imprisonment.

Some temporary laws were passed to restrict petitioning in 1819. By the forms of the houses of Parliament certain regulations must be complied with by petitioners, or their petitions will be rejected. A petition to the House of Lords must be addressed 'To the Lords Spiritual and Temporal in Parliament assembled;' the form of address to the House of Commons is, 'To the Honourable the Commons of the United Kingdom (or to the Honourable the Knights, Citizens, and Burgesses of Great Britain and Ireland) in Parliament assembled.' The petition must begin, 'The Humble Petition of . . . showeth;' if from an individual it must state his name; address and occupation must be cited. After statement of the grievance the petition must conclude with a specific prayer. No mere recital of grievances without specific statement of the remedy prayed for, will be received. Immediately before the signatures the petition must close with the words 'And your petitioners, as in duty bound, will ever pray.' One signature at least must be on the same sheet or parchment as the petition. The signatures or marks of the petitioners must be made by themselves, not by agents, however deputed. A chairman cannot sign for a public meeting, but the common seal of the corporation is received for a corporate body. The petition must be written, not lithographed, on paper or parchment, without erasures or interlineations. It must be in English, or accompanied by a translation the correctness of which is certified by the presenting member. Intemperate language or imputations on the conduct of Parliament or courts of justice are not permitted in petitions, nor reference to debates on measures in contemplation. Petitions for the remission of customs or duties can only be presented with the consent of the crown. The member presenting a petition is understood to examine if the forms have been complied with, and all petitions presented are subjected to a scrutiny in committee. Petitions addressed to members of Parliament for presentation to Her Majesty or either house of Parliament are transmitted free by post if under 2 lbs. in weight. They must be sent in covers open at the sides.—The mode of obtaining redress for the improper election of a member of Parliament is by petition to two judges of the Queen's Bench Division of the High Court.

PETITION OF RIGHT. The conflict between the crown and the Parliament had already begun, in the reign of James I., when (1621) the House of Commons framed the famous protestation that the liberties, franchises, privileges, and jurisdictions of Parliament are the ancient and undoubted birthright and inheritance of the subjects of England. This protestation James, with his own hand, tore out of the journal. The arbitrary measures of the second Stuart reign, the forced loans, benevolences, taxes imposed without consent of Parliament, arbitrary imprisonments, the billeting of soldiers, &c., finally determined the Commons to prepare a law which should protect the rights of the subject against further invasion; this they called a *petition of right*, as implying that it contained merely a corroboration or explanation of the ancient constitution, not any infringement of the royal prerogative, or acquisition of new liberties. It passed the Commons and the Upper House (1628), and after some attempts on the part of Charles I. to evade it, received the royal assent. After reciting the grievances above enumerated it provides against their repetition as contrary to the laws and statutes of the realm and the rights and liberties of the subject, and prays the king to declare that his officers and ministers should serve him according to the laws and statutes of the realm. See BILL—Bill of Rights.

PETITIO PRINCIPII, in logic, the taking a thing for true, and drawing conclusions from it as such, when it requires to be proved before any inferences can be deduced from it.

PETIT JURY. See JURY.

PETIT TREASON. See TREASON.

PETŐFI, SANDER, a Hungarian poet, born of humble parentage in the county of Pesth in 1823, received but a slender education, and had to maintain a hard struggle in youth, partly as a common soldier, partly as a subordinate member of a troop of strolling players. In 1843 he made accidentally at Pesth the acquaintance of Vachot, who perceived his literary turn of mind, and employed him on his journal called the Divatlap. The poems contributed by Petőfi to this periodical became immensely popular, and soon made their author regarded as the national bard of Hungary. In 1847 he undertook with Jókai the editing of the Eletképek, to which he furnished numerous poems and some highly successful tales. He was less fortunate as a novelist, and his Et hóhér kötele (the Hangman's Cord) was an especial failure. In March, 1848, he came forward at the head of the youth of Pesth with the celebrated twelve national requisitions, and made the revolutionary cause triumphant for the time. His spirited lyric Most vagy soha (Now or Never) was the first manuscript printed in Hungary without the supervision of the censor. He now exchanged the pen for the sword, and joined Bem's army, who appointed him his adjutant, but in consequence of a quarrel with Mészáros, who would not overlook his inattention to military discipline, he quitted the service in May, 1849, and returned to the cultivation of the muses. On the advance of the Russians, however, he again joined Bem as adjutant, and is believed to have perished in the battle of Schässburg, though doubts were long entertained as to his being really dead. Numerous pieces were composed by him amid the din of war, and a collection of his glowing battle-songs, written at this period, was published at Leipzig in 1851, and afterwards translated into German under the title of National Songs of the Magyars. A collection of his earlier poems was published in two vols. at Pesth in 1847.

PETRA, a ruined city, formerly the capital of Arabia Petræa, to which it is supposed to have given its name, in a narrow valley of the Wady Musa, surrounded by lofty and for the most part precipitous mountains, about 110 miles S.S.E. of Jerusalem. It is mentioned in Scripture (2 Kings xiv. 7; Isaiah xvi. 1) under the name of Selah, was taken by Amaziah, king of Judah, who changed its name to Jok-theel; and from the notices of it by Strabo, Pliny, Josephus, and various Christian writers, appears to have been a place of considerable extent and great magnificence, and to have at one time commanded a large share of the traffic of the East. It contains a number of remarkable excavations, and covers a large space with its ruins, but the only building actually standing, though in an imperfect and dilapidated state, bears the name of Pharaoh's House, and seems to have been a palace. It is in the form of a square, 34 yards each way. The four walls are nearly entire, and the east one is surmounted by a handsome cornice. The front facing the north was adorned with a colonnade, of which four pillars are still standing; and within the colonnade is a piazza, from which three apartments are entered, one of them by a noble arch from 35 to 40 feet high. There is also a ruined theatre, which was capable of accommodating between 3000 and 4000 spectators. Another ruin is called the Treasure-house, and is believed by the people of the place to contain somewhere buried in it the treasures of Pharaoh.

PETRARCA, Francesco, the greatest lyric poet of Italy, was the son of a Florentine exile, Pietro or Petracco di Parenzo, a notary of the republic and the friend of Dante, with whose faction he was exiled. He was born at Arezzo, 20th July, 1304. His earliest years were spent at Aneisa, in the vale of Arno, and afterwards with his father at Carpentras, near Avignon, where he began his studies. He afterwards studied law at Montpellier from 1318 to 1321, and at Bologna 1321–24. His own inclinations, however, led him to study the Latin and Provençal poets in preference to law and scholastic divinity, and he was not diverted from this preference although his father repeatedly burned his books. His mother died in 1324, and his father in the following year; and being without means he adopted the ecclesiastical profession, but without formally taking orders, and returned to Avignon, where his talent for Latin poetry commended him to the court of Pope John XXII. It was at this time that he first saw in the church of St. Claire, on 6th April, 1327, the Laura who exercised so great an influence on his future life, and dictated to him his most famous works. The identity of this personage, and whether she was a real or ideal one, has been much disputed. The latter point has been settled by the poet himself in favour of the reality of Laura; the former is still open, but the common, and doubtless the correct opinion is, that she was the daughter of Audibert de Noves, born in 1308, married in 1325 to Hughes de Sade, and who died in 1348. When the poet met her she was nineteen years of age, and two years married. The love for Laura which haunted Petrarca during the greater part of his subsequent life appears to have been purely Platonic, thanks, in the first instance at least, mainly to the virtue of the lady. He remained at Avignon three years, singing his love, and haunting her at church and in her walks. He then left Avignon for Lombez, afterwards visited Paris, Brabant, Ghent, the Rhine, Aix-la-Chapelle, Cologne, &c., and imagining a vision from Laura requesting him to return to Avignon, he returned. While here he pleaded with success before the pontifical court the rights of Azzo di Correggio, prince of Parma. The pope also conferred on him a canonry at Lombez (1335). In 1336 he embarked at Marseilles for Rome, the antiquities of which he visited with an enthusiasm which he has recorded in his poems. In 1337, after an excursion in the Pyrenees and the west of Spain, he returned to Avignon, and bought a small estate at Vaucluse, in order to be near Laura. From his own inclosure he could now see her walking in her park, which was a great happiness to him. He remained here for three years, and wrote numerous sonnets in which he has attested the fact. These sonnets acquired popularity even before the earlier and longer work of Dante (which was still in manuscript), and served to fix the Italian language. These sonnets were, however, only his recreation. He rested his hopes of fame on his Latin scholarship. Virgil, Cicero, and Livy were his favourite authors, but he was a diligent explorer of the monasteries for old manuscripts of all the Latin classics (he did not learn Greek till comparatively late in life), which he transcribed with his own hand, and diffused as much as possible, while he formed a precious collection of his own. In his travels he made valuable discoveries, which have placed his name high among the restorers of letters. He had advanced views for his age of history and science, despising legends and astrology, and recommending true research. In politics his views were equally advanced, and while he did not spare the vices of the clergy he had no sympathy with the scepticism which was common among the scholars of his day. His Latin works, both in prose and verse, were highly esteemed, and in 1341 he was called to Rome to receive on Easter-day the laureate crown awarded for his poem Africa. He was subsequently charged with various diplomatic missions, and in 1342 was appointed joint-ambassador with Rienzi to Clement VI. to solicit his return to Rome. The mission was unsuccessful, but Clement gave him a mission to Naples. He praised the enterprise of Rienzi (1347) in a Latin epistle, and went to Rome, though too late, to support him. At Parma he learned the death of Laura, which he recorded on his copy of Virgil, and celebrated in his Triumphs. He at first thought of shutting himself up in a monastery, and determined to live more in accordance with his ecclesiastical profession. His great popularity, however, caused him to be employed in many important diplomatic negotiations. He was consulted by the pope and the emperor. In 1354 he negotiated a peace between the Republics of Genoa and Venice in the name of Giovanni Visconti of Milan. From this time, with the exception of embassies to France and Germany, he lived entirely in Italy, and until 1376 chiefly at Milan, Padua, and Venice, to the last of which he presented his library. In 1370 he took up his residence at Arqua, near Padua, where he passed his remaining years in religious exercises, and where he died on 18th July, 1374. He had two natural children by an Avignon lady—a son who pre-deceased him, and a daughter who married Francesco de Brossano, a Milanese gentleman who became his executor. Petrarca left no works in Italian prose. Among his Latin works are three books of Epistles (Epistolæ familiares) and twelve Eclogues, his poem Africa, various philosophical, religious, political, and historical treatises, as De officio et virtutibus imperatoris; De vera sapientia; De contemptu mundi; Itinerarium syriacum (a geographical work); Epitome vitarum virorum illustrium, &c. His Italian poems consist of Sonetti and Canzoni in vita e in morte di Laura, and of Trionfi. The first edition is dated Venice, 1470. The subsequent editions are innumerable. The Trionfi are in terza rima. Despite their refinement and delicacy of sentiment and purity of language, the sonnets of Petrarca are somewhat dull and monotonous. They are also filled, according to the taste of the age, with conceits, artificial refinements of sentiment, and plays upon words.

Of biographical and critical notices of Petrarca we may mention An Historical and Critical Essay on the Life of Petrarch, with a Translation of a few of his Sonnets, by Alexander Fraser Tytler, Lord Woodhouselee, Edinburgh, 1810; The Life and Times of Petrarch, by Thomas Campbell (the poet), London, 1841; Pétrarque, Etude d'après de nouveaux Documents, par Alfred Mézières, 1867.

PETREL, a genus of Natatorial Birds, forming the type of the family Procellaridæ, included in the Longipennate section of the order—the latter name being applied to the section from the well-developed nature of the wings in its members. The Petrels possess a rudimentary hinder toe. The upper mandible is very strongly hooked, the lower mandible being abrupt or truncated at the apex. The extremity of the upper mandible appears of a distinct piece from the rest of the bill. The nostrils form a tubular structure lying along the upper surface of the mandible. These birds are popularly termed 'mother Carey's Chickens' by seamen. They are found in every part of the world, on the ocean, at great distances from land, generally at twilight or in stormy weather. They feed on small marine animals and seeds of sea-weeds, and appear exceedingly fond of fat or grease, for which, and for fish startled to the surface, they will follow in the wake of

ships for great distances. These birds breed in rocks adjoining the sea, forming their nests in cavities; the female lays two eggs. They fly rapidly, and generally close to the water; and when in pursuit of food they suspend themselves by extending their wings, and appear to run on the surface of the water. Buffon says it is from this circumstance that they are called *petrels*, after the apostle Peter, who walked on the water. The appearance of these birds is considered by seamen to presage a storm—hence the common name of a familiar species known as the 'stormy petrel'—and it is thought peculiarly unlucky to kill one of them. The family Procellariidæ itself includes several sub-families, that of the *Procellariæ* including the true petrels. The Stormy Petrel (*P.* or *Thalassidroma pelagica*) is a well-known member of the group. It is the smallest of natatorial birds, measuring only 6 inches in length. Its general colour is a dull or sooty black, with a cross band of white on the rump. The bill and feet are black. This bird, although found in Europe and on the British coasts, is more common in North America. The *P.* or *T. Wilsonii*, is another species of petrel, inhabiting the American coasts, and only accidentally occurring in European seas. The *P. Leachii*, or Fork-tailed Petrel, and *P. oceanica* are also familiar species. The Fulmar (see FULMAR) is occasionally termed the Fulmar Petrel; whilst the Blue Petrel (*Prion vittatus*) is a rarer form, and has been included in a separate genus of the family. The Great Black Petrel (*P. æquinoctialis*) of Edwards is a larger and more rapacious form than the other species. The Cape Petrel (*P. Capensis*) is represented on Pl. CLII.–CLIII. fig. 6.

PETRIFACTIONS. See PALÆONTOLOGY.

PETRIKAU, *or* PIOTRKOW, a town of Russian Poland in the government of the same name. It is a place of some antiquity, with a ruined castle, but is now in a declining state. Pop. 18,000.

PETROLEUM, the general name given to an oily liquid found in different parts of the earth. Petroleum is a mixture of hydrocarbons, chiefly belonging to the marsh-gas (CH_4) series. See BITUMEN.

Springs of mineral oil or liquid petroleum are found in almost all localities where bitumen or asphalte exists in quantity in the rocks. They are found in British Burmah, Persia, on the south-west shores of the Caspian Sea, and especially in North America. The existence of these wells has long been known. Even in America the oil of the Pennsylvania wells was collected and sold by the Seneca Indians under the name of Seneca oil. It is only recently, however, that the importance of this article as a commercial product has been discovered. Attention appears to have been first directed to it by the successful manufacture and sale of paraffin in this country. The enormous returns realized by the first speculators gave an unprecedentedly rapid expansion to the trade; towns rapidly sprung up in the Pennsylvanian oil district, railways were already formed through the district, and the extent of operations has been since continually expanding. A similar but less prolific district has been found in Upper Canada. The oil district in Pennsylvania is in the north-west corner of the county. Titusville, Oil City, Corry Plummer, Pithole City, and several other towns have been created or raised into prosperity by the trade. The enterprise began in 1853, but until 1860 it took very little expansion. The first borings were not very deep, and the oil was allowed to flow naturally; but when the surface springs were exhausted intermediate strata were bored through, and new and apparently inexhaustible sources of supply were found at a depth of 600 or more feet. The oil is found mixed with salt water and inflammable gases, which frequently raise it to the surface without the aid of pumps. Pumping is, however, resorted to when the pressure of the gas has diminished. The mode of boring is similar to that of trial-boring for coal. Some of the wells yield 1000 or 2000 barrels a day. Philip's Well gave 3000 barrels a day for six weeks. The district principally worked is between Titusville and Oil City, a distance of about 15 miles, but the oil district extends over an area of 2000 square miles. In 1862 the entire product of Pennsylvania amounted to about 80,000,000 gallons, in 1870 it had reached 154,000,000, in 1871 it exceeded 220,000,000. In 1882 the total product of the oil region of the States was 1,260,000,000 gallons, of which 556,220,000 gallons valued at £70,254,000 were exported. About two-thirds of the total quantity exported were shipped at New York.

The dangerous character of petroleum has caused several acts of Parliament to be passed to regulate its storing and use. That which is now in force is the 34 and 35 Vict. cap. cv., passed 21st August, 1871. The keeping of petroleum without a license from the local authority is liable to a penalty of £20 for each day, unless it is kept, whether for sale or private use, in separate glass, earthenware, or metal vessels, securely stopped, and containing each not more than 1 pint, and that the aggregate amount so kept does not exceed 3 gallons. When petroleum is kept more than seven days at the place at which it is imported or conveyed by land or water, the vessel containing it must have a label in conspicuous characters stating the description of the petroleum, with the addition of the words 'highly inflammable,' and the name and address of the consignee, owner, sender, or vendor in case of its being exposed for sale. Penalty for infringement of this regulation, £5. Both in this case and that of omitting to take a license the petroleum is forfeited in addition to the penalty.

PETROMYZON. See LAMPREY.

PETRONIUS, TITUS, a Roman author, notorious for his licentiousness, was born at Marseilles, and lived in the court of Nero. He was for a time the favourite of the emperor, who made him master (elegantiæ arbiter) of his voluptuous banquets and revelries. But he finally fell a victim to the suspicions of the tyrant, on account of which he put himself to death. To him many authorities attribute the Satyricon Libri, a work of fiction of great ability and licentiousness, of which only fragments have been preserved, but other authorities attribute it to other authors and to a later period. Niebuhr, Schmitz, Meyer, Studer, and Ritter have discussed the question. The best critical edition is that of Burmann (Leyden, 1743, two vols. 4to); there is a smaller edition by Anton, on the basis of Burmann's (Leipzig, 1781).

PETROPAVLOVSK, a town and harbour of Asiatic Russia, formerly capital of Kamtchatka, on the east coast of Kamtchatka, on the North Pacific Ocean, with a fort and lighthouse. It was bombarded by the Anglo-French fleet in 1854. Pop. 479.—Also a town of Central Asiatic Russia, in the government of Akmollinsk, on the Ischim. Pop. 11,406.

PETROVSK, a town of Russia, in the government and 70 miles N.N.W. of the town of Saratov, near the right bank of the Medvieditza, on the slope of a hill crowned by the ruins of a fortress. It has a trade in corn. Pop. 10,771.

PETROZAVODSK, a town in Russia, capital of the government of Olonetz, on the Lossolenka, where it falls into Lake Onega, 192 miles north-east of St. Petersburg. It is poorly built; has an important marine and cannon foundry; a gunpowder, fulling, and several saw mills, and considerable manufactures of iron and copper ware, which find their principal market at St. Petersburg. Pop. 10,910.

PETTY BAG, an office of the court of chancery out of which writs issued in matters wherein the crown was mediately or immediately concerned; such as *congés d'élire* for bishops, &c.

PETTY OFFICERS. See OFFICERS.

PETTY SESSIONS, in England, are sessions of two or more justices of the peace, on which power is conferred by various statutes to try minor offences without jury, and to take cognizance of indictable offences, and commit the parties after examination of witnesses for trial at quarter-sessions or assizes. Each county in England is subdivided into petty-sessional divisions, which are arranged by the justices in quarter-sessions, to whom there is generally an appeal from the petty sessions. Each petty sessional division has a clerk, who is the legal adviser of the justices.

PEUTINGER TABLE, a map showing the military roads of the greater part of the kingdom of the Visigoths, drawn, it was formerly believed, for Theodosius the Great. It is called after Conrad Peutinger, a German scholar, born 1465, and who died in 1547. Among his papers was this famous map. Conrad Celtes, who found it in the Benedictine monastery of Tegernsee, borrowed and did not return it. Such a *mappa mundi in rotulo* was extant in that convent in 1502; and the Tabula Peutingeriana at Vienna is probably the same which Werinher, a poet, made or copied in 1190. Celtes gave this map to Peutinger, who intended to publish it. After his death it disappeared for many years, until Marx Welser published fragments of it, under the title of Fragmenta Tabulæ antiquæ ex Peutingerorum Bibliotheca (Venice, 1591). It was not found entire among Peutinger's manuscripts until the eighteenth century, when Scheyb published a beautiful impression, with remarks (folio, Vienna, 1753). The manuscript of the map is at present in the imperial library at Vienna, where an additional leaf of it was some time ago discovered. The characters and figures show that the map is not the original. Docen thinks that it belongs to the twelfth century. A new impression of this ancient map was published in Leipzig (1824), not entirely free from faults, with a treatise by Mannert. Peutinger was the first who collected Roman inscriptions on stone, in a small work—Romanæ Vetustatis Fragmenta (Augsburg, 1505). He wrote, besides other valuable works, on the decline of the Roman Empire. Peutinger also held for a long period important public offices.

PEWS (Old French, *pui*, from Latin, *podium*, a parapet or balcony), inclosed seats in a church. Pews were in use before the Reformation, but are now seldom found in Roman Catholic churches on the Continent. In England pews are held in the Established Church by two tenures, first by prescriptive right, when they descend as an heir-loom independently of ecclesiastical concurrence; second, all pews not so held are at the disposal of the ordinary (bishop of the diocese) for behoof of the parish, and are under him distributed by the churchwardens to the parishioners according to their rank. The bishop may grant the right to sit in a particular pew. In the disposal of the pews or seats in the area of parish churches in Scotland parishioners have a preferable claim (for the special purpose of attending divine service) according to the valued amount of their rent. The disposal of pews or seats in Dissenting churches is of course purely a matter of private arrangement. They are commonly let to defray the congregational expenses. In America they are sometimes put up to auction.

PEWTER consists of tin alloyed with a quantity of copper, or other metallic bodies, as the experience of the workmen has shown to be the most conducive to the improvement of its hardness and colour, such as lead, zinc, bismuth, and antimony. The best sort of pewter is formed from antimony 17 parts, tin 100 parts. The French add a little copper to this kind of pewter. A very fine silver-looking metal is composed of 100 lbs. of tin, 8 of antimony, 1 of bismuth, and 4 of copper.

PEYER'S GLANDS. See INTESTINE.

PEYROUSE, LA. See LAPÉROUSE.

PÉZENAS, a town of France, in the department of Hérault, on the left bank of the Hérault, at the confluence of the Peine, 25 miles W.S.W. from Montpellier. It is well built, has several spacious streets, the ruins of an old castle, a fine parish church, and a theatre; manufactures of linens, napkins, muslin, moleskins, woollen and cotton covers, hats, soap, and chemical products; several cotton and silk mills, extensive distilleries; and a trade in grain, dried fruit, wood, olive-oil, capers, cotton, silk, wool, and more especially brandy, wine, and spirits. Pop. 7364.

PEZOPHAPS. See SOLITAIRE.

PEZOPORUS. See PARAKEET.

PFAFF, CHRISTIAN HEINRICH, an eminent chemist and natural philosopher, born in 1772 at Stuttgart, was educated in the gymnasium there, and in the Charles Academy, where he showed a decided inclination for natural science, and became acquainted with Cuvier. His interest in electricity was first awakened by the celebrated experimenter Gross, and he made it the subject of his first literary labour, in his thesis entitled De Electricitate sic dicta animali. In 1793 he went to Göttingen, where he published the results of his galvanic inquiries in his work Ueber thierische Electricität und Reizbarkeit. He afterwards spent some time in Copenhagen; then went with a noble family as physician to Italy, and after his return practised in Heidenheim till 1797, when he accepted of an invitation to become an extraordinary professor at Kiel. After visiting Paris in 1801, at the expense of the Danish government, he returned to occupy the chair of chemistry, and rank at the same time as a member of the medical faculty. This gave him an opportunity of directing his attention particularly to pharmaceutical chemistry. He was thus led to the composition of his most important work, entitled System der Materia Medica nach Chemischen Principien (seven vols. 1808–24). He formed a laboratory in Kiel, and collected a rich physical apparatus, which government afterwards purchased. At the same time he took an active part in everything relating to physics and chemistry, as is apparent from his numerous papers in the journals devoted to these subjects, and also from his separate writings, among which may be mentioned Handbuch der analytischen Chemie (two vols., Altona, 1824–25); Ueber und gegen den thierischen Magnetismus (Hamburg, 1807); Der Electromagnetismus (Hamburg, 1824); Parallele der chemischen Theorie und der voltaischen Contacttheorie der galvanischen Kette (Kiel, 1845); and Die Asiat. Cholera-epidemie im Herzogthum Holstein im J. 1850 (Kiel, 1851). He died at Kiel in 1852. His brother, John Frederick, who was born in 1765 and died in 1825, was professor of mathematics, first at Helmstädt and then at Halle, and has acquired an honourable name in the history of mathematics by his Disquisitiones Analyticæ (Helmstädt, 1797).

PFEFFERS, PFÄFFERS, or PFÄVERS, a small town of Switzerland, in the canton and 31 miles east of St. Gall. It is famous for its baths, situated in the vale of the Tamina, about 4 miles above the village, in what has been described as one of the most extraordinary spots, even in Switzerland. The baths are situated on a narrow ledge of rock a few feet above the impetuous torrent, and the buildings which form them, consisting of two piles connected by a chapel, are so deeply sunk between the rocks that the sun,

in the longest summer day, is visible above them only from ten to four o'clock. From 200 to 300 patients can be received at a time. The spring has a temperature of nearly 100° Fahr. Their great efficacy is undeniable, but is not easily explained, as a pint of the water contains scarcely 3 grains of saline particles. The spring generally ceases to flow in winter, but continues from spring to autumn, from which it is probable that the spring is due to the melting of snow and ice. Since 1840 the waters have been conveyed by wooden pipes to the village of Ragatz, below the gorge, a distance of about 2½ miles. In a high valley above the gorge is situated the ancient Benedictine abbey of Pfeffers, only recently suppressed. It is a vast edifice, built in 1665, in place of another destroyed by fire, and is now used as a lunatic asylum under the name of St. Pirminsberg.

PFEIFFER, Ida, an Austrian lady noted for her indefatigable exertions as a tourist, was the daughter of a merchant in Vienna, and born there in 1797. Her father was a man of an eccentric disposition, giving her a boy's education, and carrying out his theories so far as to have her attired in boy's clothes. His death put a stop to this Amazonian system of upbringing; but Ida retained all her predilections for boyish occupations, and resolutely resisted all attempts to instruct her in female accomplishments. Having contracted an attachment for a young man who acted as her tutor, her mother refused her consent; and having been badgered by several other suitors courting her under the maternal sanction, she at length in despair wedded Dr. Pfeiffer, a lawyer and a widower, twenty-four years older than herself. Her husband held an office under the Austrian government; but having given offence, it is said, by his incorruptibility of principle, was dismissed from his appointment, and for many years the family had to struggle with extreme want and poverty, Madame Pfeiffer endeavouring to eke out a living by teaching. Her fortunes at length improved, and she was enabled to get her two sons established in life. About this time her husband died. Being thus freed from domestic engagements, she resolved to carry out what had been her dream through life—the exploration of foreign countries. Having managed to hoard up a small sum for effecting this object, she set out in 1842 on her first journey, which extended over Turkey, Palestine, and Egypt. An account of her wanderings was published on her return, and excited considerable interest. Another tour was undertaken by her in 1845 to Scandinavia and Iceland, of which she also published a narrative. In May, 1846, at the age of fifty-one, she started on a journey round the world, sailing from Hamburg to Rio de Janeiro, visiting the interior of Brazil, and afterwards proceeding by sea round Cape Horn to Chili, from which she crossed the Pacific to China, stopping for a short time at Tahiti. From China she proceeded by Singapore to Calcutta, crossed the country to Bombay, from which she sailed to Bassora in the Persian Gulf, travelled in a caravan to Mosul, and then journeying through Persia and Circassia, reached Constantinople, from which she returned to Vienna by Athens and Trieste in November, 1848. She published an interesting account of this journey, which attracted considerable attention both on the Continent and in England, where a translation of it appeared. Madame Pfeiffer had now become a traveller of some note; but the main object of her wanderings seems to have been merely to gratify a strong inherent longing for seeing foreign lands, and she had no purpose to serve either in the way of scientific or ethnological investigation. She indeed disclaims all pretensions to a knowledge of science, though she appears to have made some meteorological observations, and also formed some collections of insects. A sum of £100 was granted her by the Austrian government to prosecute her travels, and in 1851 she arrived in London, from which she sailed to the Cape of Good Hope, intending to penetrate from thence into the interior of Africa, but the expense of travelling there proved so enormous that she abandoned the idea. She then sailed for the East Indies, visited Borneo, Java, and Sumatra, and exposed herself fearlessly amid the savage and cannibal tribes in these islands. Nothing is more remarkable in all the wanderings of this extraordinary woman than the collectedness and undaunted courage which she, a solitary female, maintained in conjunctures which would have tried the courage of many men. After visiting the Moluccas she crossed the Pacific to California, sailed down the west coast of America, crossed the Andes, and then returned to London in 1854, taking the United States in her way. The last journey accomplished by her included the Island of Madagascar, which she visited from the Mauritius. After undergoing much suffering and privation, and narrowly escaping with her life from the hands of the diabolical Queen Ranavola, Madame Pfeiffer contrived to effect her return to Europe. Her fatigues, however, had told fatally on her constitution, and after lingering for a time she expired at Vienna on 19th October, 1858.

PFORZHEIM, the most important manufacturing town of the Grand-duchy of Baden, in the circle of Carlsruhe and 15 miles south-east of Carlsruhe, is situated on the northern edge of the Black Forest, and at the junction of the Nagold with the Enz. Among its buildings are to be mentioned the remains of an ancient castle, which was formerly the residence of the margraves of Baden-Durlach, the castle church, erected in the twelfth, thirteenth, and sixteenth centuries; and the town-house, a handsome building. The chief industry of the place is the manufacture of trinkets, which employs 7000 hands, the produce being sent to the chief markets of the world; there are also chemical works, machine-works, several establishments for the production of silver wares; forges, and tanneries. In the neighbourhood are copper-works, bleachfields, paper-mills, oil-mills, saw-mills, &c. The trade in wood is important, the timber being floated by the Enz and Neckar to the Rhine. There is also a considerable trade in oil, fruit, wine, and cattle. The trade has been materially increased by the construction of railways. The inhabitants distinguished themselves in the Thirty Years' war. Reuchlin, one of the most distinguished precursors of the Reformation, was born here. Pop. (1880), 24,037.

PHÆDO, of Elis, a scholar of Socrates, and founder of a school of philosophy in Elis. The dialogue of Plato on the immortality of the soul, which contains the last conversation of Socrates with his scholars while he was in prison, bears his name; but it is said that Phædo repudiated the part set down to him in the dialogue of Plato, and no inference can be drawn from it as to his teaching. None of Phædo's writings, which were in the form of dialogues, have come down to us. Mendemenus, who founded the Eretrian branch of the Eleatic school, was indirectly a disciple of Phædo, but to what extent he followed his views is unknown.

PHÆDRA, in Greek mythology, daughter of Minos, king of Crete and of Pasiphae, was the sister of Ariadne and wife of Theseus. Happening to meet Hippolytus, her step-son, whom she had never before seen, and whom she did not know to be the son of Theseus, she was inflamed with an ardent passion for the beautiful youth. He would not reciprocate her passion, and to satisfy her revenge she accused him

to her husband of a criminal attempt upon her honour. The father cursed his son, and Neptune soon carried his execrations into effect by bringing upon Hippolytus a violent death. When this event was known in Athens Phædra repented of her crime and hanged herself. According to some she was killed by Theseus. Sophocles and Euripides, two of the most celebrated poets of antiquity, have taken Phædra as the subject of their tragedies, which are now lost. Racine has followed their example.

PHÆDRUS, a Latin writer of the Augustan age, who translated and imitated the fables of Æsop in iambic verse. Little is known of him but from his own writings. He was a slave brought from Thracia or Macedonia to Rome, and manumitted by Augustus. He lived in the reign of Tiberius, and seems to have suffered some oppression or injustice from the tyranny of Sejanus. Some authorities have doubted the genuineness of the fables ascribed to Phædrus, chiefly it appears on the ground of a statement of Seneca, that the Romans had not attempted fable writing, and the general silence of other Roman writers about Phædrus. The style of the fables is, however, favourable to the supposition of their genuineness. There are five books containing ninety-seven fables attributed to Phædrus, which are generally supposed to be genuine. In the prologue to the first book the author announces his work as a free translation of Æsop; in subsequent books he intimates having taken greater liberties with his subject, and introduced fables of his own under the name of Æsop. The first edition of this collection was published by P. Pithon (Troyes, 1596); the best is a critical edition by J. C. Orelli (Zürich, 1831). A further collection of thirty-two fables ascribed to Phædrus, but of which the authenticity is much more doubtful, was published at Naples in 1809 by Cassitti from a MS. of N. Perotti, to whom some authorities have ascribed the five books.

PHAËTHON (by English writers commonly spelled *Phaeton*, which name is given after the god to a light carriage), in Greek mythology, the offspring of Helios and Clymene, and brother of the Heliades. To please his unfortunate mother, and to satisfy those who doubted whether the Sun were his father, he desired the latter to grant him a favour. Helios imprudently promised it unconditionally, and swore by the Styx that he would at all events keep his word. Phaëthon now asked permission to take his father's place in the chariot of the Sun, and would not be denied. But he had scarcely mounted the flaming car and taken the reins, when the celestial horses, despising their weak driver, turned out of the path, and set everything on fire. The Ethiopians, on the left, were blackened by the near approach of the Sun; and when the chariot was drawn over the earth to the right, Zeus with his bolts plunged the thoughtless charioteer into the river Eridanus or Po. His sisters found him there lifeless, and lamented him. They were changed into poplars, and their tears into amber. The god of the sun was also called Phaëthon (the enlightener).

PHALANGERS (*Phalangistidæ*), a group of small marsupial Mammalia, included in the Carpophagous or fruit-eating section of that order, and deriving their name from the fact that the second and third toes of the hinder feet are united almost to their extremities. All the feet possess five toes. The incisor teeth number six in the upper and two in the lower jaw; the canines are always of small size, those of the lower jaw being occasionally undeveloped. The tail is generally elongated and prehensile, but, as in one genus (*Phascolarctos*), it may be rudimentary. The great toes are opposable, and are destitute of nails, the other digits being provided with curved nails. These animals are visibly adapted for an arboreal life, and inhabit the trees of the forests of Australia and the Eastern Archipelago. They are nocturnal in habits, and feed upon fruits and leaves, but appear also to devour young birds. In confinement they are found to prefer flesh as an article of diet. They are eaten by the natives of the countries in which they occur, although the flesh is said to emit a strong and offensive odour. The stomach is of simple structure, the intestine being provided with a long cæcum. The Australian Opossum (*Phalangista vulpina*) is the best-known species of Phalanger. This form is not a true opossum, the latter genus occurring solely in America. This animal is hunted by the Australian colonists. It averages about 1½ foot in length, the bushy tail being about 13 inches long. The colour is a grayish black, the under parts and inner aspects of the limbs being of a yellowish white colour. *P. cavifrons* or 'Capoul' is another species, found in New Ireland. The Phalangers proper are sometimes divided into two groups, the first of which includes those species found only in Australia and Tasmania, and possessing longish ears and a tail which is completely hairy throughout. The second group embraces Phalangers inhabiting the islands of the Eastern Archipelago exclusively, and which possess short ears and tails with the tips bare or destitute of hairs. The natives of the Moluccas term these forms *Cuscus* or *Cousous*. *P. ursina*, *P. Cookii*, *P. maculata*, *P. fuliginosa*, *P. gliriformis* are also known species. The *Petauri* or Flying Phalangers are also included in this family. These latter are distinguished by the possession of a *patagium* (which see)—consisting of folds of skin extending along the sides of the body, between the fore and hind limbs—which acts as a parachute and supports these animals in their aerial leaps from tree to tree. They want the prehensile tails of the ordinary Phalangers. Their fur is soft and glossy. They are nocturnal in habits. *Petaurus Taguanoides* is the largest species, and averages about 2 feet in length, inclusive of the tail. *P. sciureus* is a well-known form, the fur being much valued on account of its silky texture. This species is coloured gray above, with darker colour on the head and white on the under parts. A black hue runs along the back, the patagium being marked along the sides by a similar band. A circle of black surrounds each eye; a blackish line running along the hinder limbs on their upper surface. The tip of the tail is also coloured of a darker hue. This form inhabits New South Wales. None of the Flying Phalangers inhabit Van Diemen's Land. *P. flaviventer* and *P. macrurus* are also allied species of Petauri; whilst the Pigmy Petaurus (*P. pigmæus*) is the smallest species, and is not much larger in size than an ordinary mouse.

The genus *Phascolarctos*, represented by the *P. cinereus*, the 'koala' or 'native sloth' or 'bear' of the Australian colonists, is nearly allied to the Phalangers. It is, in fact, intermediate between these forms and the Kangaroos. It possesses a rudimentary tail. The thumbs and great toes are opposable to the other digits, which are provided with claws. See KOALA.

PHALANGES, the name applied to the separate bones of which the digits (or fingers and toes) of vertebrates are composed. Each digit or finger of the human hand consists of three phalanges, with the exception of the pollex or thumb, which is composed of two only. The basal or proximal phalanx of each finger—that next the palm—is the longest, and they become successively smaller; the last or terminal phalanges which support the nails being the smallest of all. The same number is followed in the toes, the great toe or hallux, like the thumb,

being formed of two phalanges only. The phalanges of the great toe are much larger than those of the other toes, and the second and third phalanges of the little toe may frequently be found ossified together. In lower vertebrates the number of phalanges varies greatly from what obtains in man. In other mammals —save in Cetaceans or Whales—the phalanges number the same as in man. In *Dasypus villosus*, one of the armadilloes, the phalanges of the three ulnar digits increase in length as they approach the end of the finger. There are fourteen phalanges in the third digit of *Globiocephalus*, one of the Cetacea. The terminal phalanges in the Cats (Lions, &c.) develop broad, bony plates for the support of the claws. The phalanges of the toes may also exceed those of man in number. The terminal phalanges of the toes bifurcate in the Short-tailed Pangolin, and those of the Cats exhibit the same conformation as the phalanges of the fingers.

PHALANGIDÆ, a family of Arachnidans, represented by the familiar Harvest-spiders (*Phalangium*), and included in the section or order of the Adelarthrosomata. The legs in the Harvest-spiders are exceedingly long. The maxillary palpi exist in the form of filamentous appendages, which terminate in simple, hooked processes. The abdomen is distinctly divided into segments or somites. These forms are not to be confused with the true spiders, from which they differ in possessing a jointed abdomen and other traces of lower organization. The Harvest-spiders are common among grass and plants. They appear to subsist on insects, and are of voracious nature. Several of the foreign species possess abdomens of remarkable conformation.

PHALANX, a word used by the Greeks (especially in the plural) to designate generally the line or ranks of an army in order of battle; more specifically the mode of formation of the heavy infantry of the Greek armies. Three Greek states acquired renown for their superior organization and use of the phalanx —Sparta, Thebes, and Macedon. In all of them it consisted of infantry in close array, heavily armed, with long spears as their principal weapon. The organization of the troops composing the phalanx varied in different states, but generally they were arranged in regular divisions under officers of various ranks, as in a modern army. The Spartan phalanx varied in depth, according to circumstances, but was commonly eight deep. It moved to the music of flutes, much importance being attached to rhythmical movement. The Theban phalanx, particularly under Epaminondas, was much deeper. At the battle of Leuctra he kept one of the two divisions into which the phalanx was usually divided retired, using it to strengthen the other wing in depth. The phalanx was perfected by Philip of Macedon. He increased the length of the spears to 24 feet, and the lines were arranged at such intervals that the spears of the fifth rank projected 3 feet in front of the first, so that the front was protected by a solid array of five lines of spears. The men were also armed with large shields which nearly covered their body, and defended by helmets, coats of mail, and greaves. The nucleus of the Macedonian phalanx was a *syntagma*, or complete square of sixteen men each way. These were combined in various groups—a chiliarchy containing four syntagmas, a merarchy two chiliarchies, two merarchies the phalanx of 4096 men, and four phalanxes the great phalanx of 16,384 men. The lowest division was the lochos or enomotia, consisting of a single file of sixteen men.

PHALARIS, a ruler of Agrigentum in Sicily, celebrated in tradition for his cruelty, but of whose life and character there is little authentic information. His reign is said to have lasted sixteen years; its commencement may be placed about B.C. 470. He was a native of Agrigentum, and appears to have been raised to authority by his fellow-citizens, and afterwards to have usurped despotic authority. He extended his dominion both by war and policy, but ultimately perished in a popular insurrection. The best known story of the cruelty of Phalaris is that of his burning his victims in a brazen bull, within which a slow fire was kindled, while their cries resembled the bellowing of the bull. It is added that he first tried this instrument of torture upon Perillus, its inventor. The story of the bull is of considerable antiquity, but the last circumstance is probably a later addition. At a later period the traditional character of Phalaris underwent a change. His cruelty was represented as due to the constraining force of circumstances upon a naturally mild disposition. He now acquired the character of a lover of literature and philosophy. It was in this last character that the spurious epistles of Phalaris were attributed to him. See BENTLEY (RICHARD).

PHALAROPE, a genus of Grallatorial or Wading Birds belonging to the Scolopacidæ or Snipe family. They form the sub-family Phalaropinæ. The bill is slender, and depressed at the base, the two mandibles being grooved to the apex. The extremity of the upper mandible is obtuse, and curved over the tip of the lower mandible, which latter is awl-shaped. The nostrils exist at the sides of the base of the mandibles, and are surrounded by a membranous patch. The feet are of moderate size, the toes, like those of the coots, being fringed with membranous lobes, enabling these birds to swim with great facility. The front toes are united up to the first joint. The hinder toe does not possess any membrane. The wings are of moderate size, the first and second quills exceeding the others in length. The Phalaropes exist on the sea-coasts in flocks of small size. They more rarely occur in fresh-water lakes, and are occasionally met with swimming out at sea at considerable distances from land. These birds are said never to dive. They feed on Crustacea, Mollusca, and insects, which they obtain by groping with their bills in the water. The nest is built amongst the grass on the sea-coasts. From four to six eggs are produced, and both sexes incubate. The flesh is oily and unpalatable. Their *habitat* is the far north and Arctic regions, but in winter they visit the shores of more southern and temperate lands. Two species thus visit Britain in winter. Several sub-genera are included under the chief genus *Phalaropus*. That genus is itself represented by the *P. hyperboreus* (or *fulicarius*), the Red-necked Phalarope, which is coloured black, varied with ferruginous tints, and with red on the under parts. The winter plumage is cinereous, with white beneath. *P. platyrhynchus* is the Gray Phalarope, which possesses a wide bill, flattened at its base, the tail being long and rounded. This species is sometimes—as by Wilson—included in the sub-genus *Holopodius*. The Gray Phalarope in its winter plumage is coloured a bluish gray, with white beneath, and possesses a chestnut patch and black band on each side of the neck. This bird inhabits the Arctic circle, the eastern portions of Northern Europe, the Caspian Sea, and the northern shores of the American continent. It migrates southwards as far as Mexico in winter, and at that period may be found in Britain. The eggs are coloured greenish brown, with black spots. The sub-genus *Lobipes* is another section of the genus, and is sometimes employed to include the *P. hyperboreus* above described.

PHALLUS (Greek, *Phallos*), the male organ of generation, a symbol of the productive powers of nature in almost universal use in ancient religions. It is impossible to trace the origin of this symbolism, which is so widely diffused as probably to indicate

a spontaneous origin among different races. The source, however, from which it has spread most widely has undoubtedly been an eastern one. In Egypt this symbolism was associated with the worship of the bull Apis, and with the feasts of Osiris, the solar divinity. Elsewhere the phallus, together with the female organ of generation, represented the fertilizing powers of the sun and earth. The same symbolism is found among the Phœnicians and Babylonians, and it is one of the modes of false worships which the Jews adopted from their idolatrous neighbours, and which were continually denounced by their prophets. Similar symbols have been found in Mexico, and in India they are everywhere common to this day. (See LINGAM.) Some of the Egyptian conquerors are said to have diffused them widely on the routes of their conquests.

In Greece these symbols did not appear in the primitive mythology of the Hellenic race. They were introduced with the worship of Dionysus, and afterwards applied to that of other divinities, particularly of Demeter, Aphroditē, and Apollo. However natural may have been the analogies which led to the use of these symbols, and however general and ideal may have been the conceptions intended to be conveyed by them, they everywhere sooner or later became associated with obscenities and licentious rites. This was especially the case in Rome in the latter part of its history, where the offences produced by these rites were so great that they had to be forbidden by law. The women carried the emblem in procession from one temple to another. They wore them as amulets; and this practice subsisted long after the fall of the Roman mythology, and well on into the middle ages. It was prohibited by councils of the church at Mans in 1247, and at Tours in 1396.

PHANEROGAMOUS, or PHANEROGAMIC, one of the two great divisions of the vegetable kingdom, consisting of those plants which have open blossoms or organs of reproduction; the other class, *Cryptogamic*, being non-flowering, or with concealed organs of reproduction. See BOTANY.

PHANTASMAGORIA, a term applied to the effects produced by a magic-lantern.

PHARAOH, the name given in the Bible to the kings of Egypt, corresponding to the P-RA or PH-RA of the Egyptian hieroglyphics, which signifies the sun. The identification of the Pharaohs mentioned in Scripture, particularly the earlier ones, is a matter of great difficulty, owing to the uncertainty of the chronologies on both sides.

The Pharaoh mentioned in the time of Abraham cannot very well be identified. If the common Scriptural chronology is correct he was probably one of the shepherd kings, but to this conjecture no very high probability can be attached. Of the Pharaohs in the time of Joseph and Moses, although we have many more details regarding them, little more can be said, and no greater certainty exists as to their identity. (See JEWS.) The two Pharaohs mentioned in the reign of Solomon, the one who gave his sister-in-law to Hadad the Edomite, and the one whose daughter Solomon himself married likewise remain unidentified. The Pharaoh mentioned as the opponent of Sennacherib was probably the Sethos of Herodotus. Pharaoh-Necho is the first Pharaoh mentioned in the Bible whose proper name is recorded. He is mentioned by Herodotus under the name Nekōs, and was probably the fifth or sixth of the Saïte twenty-seventh dynasty. Pharaoh-Hophra was the second in succession after Necho. He is identified with Apries, who reigned from about 590–571 B.C., but the dates of both the beginning and end of his reign are variously stated. Several kings of Egypt are mentioned in the Bible who are not called Pharaoh.

PHARISEES, a religious sect among the Jews which had risen into great influence at the time of Christ, and played a prominent part in the events recorded in the New Testament. The Pharisees are not mentioned in the Old Testament or the Apocrypha; they are, however, commonly identified with the Assideans (that is, *chasīdīm*, godly men) mentioned in the first and second books of Maccabees (first, ii. 42; second, xiv. 6, &c.) An improbable interpretation refers the word translated 'saints' (chasīdīm) in Psalms lxxix. 2; xcvii. 10, &c., to the Pharisees. The most probable account of the origin of the Pharisees as a distinct sect is probably that which refers it to the reaction against the attempt of Antiochus Epiphanes to break down the distinctions between his Jewish and Greek subjects. Even before the time of Antiochus (see JEWS) a spirit of compromise and conformity to Gentile customs had been springing up among the Jews themselves. The Pharisees organized the national opposition to this breaking down of the ancient barriers of their faith; but their zeal, as testified by the apostle Paul, was narrow, bigoted, ignorant, and intolerant; and among the charges which our Saviour brought against them a prominent place is given to that of misunderstanding and misinterpreting their own prophets. Josephus, who was himself a Pharisee, gives in his several works brief statements of their doctrines; but his accounts are somewhat affected, and being written for Gentile ears, which he was by no means unwilling to please, they are harmonized to a philosophical diction, which was not the natural language of the Pharisees. In the second book of the Jewish War he says (chap. viii. s. 14): 'The Pharisees, who are reputed accurate expositors of the laws, and hence derive their fundamental dogma, ascribe everything to fate and God; but admit that to act rightly or otherwise rests for the most part with men, though in each case fate co-operates. Every soul they hold to be indestructible; but maintain that those of the good alone migrate into other bodies, while those of the bad suffer eternal punishment.' 'The Pharisees,' he adds, 'regard each other with affection, and cultivate public concord. The manners of the Sadducees towards each other are ferocious, and in their intercourse with their own fraternity they are as wanting in urbanity as with aliens.' The doctrines held by the Pharisees and by the Sadducees Josephus calls 'the philosophical systems' of the Jews.

The source from which the most minute and detailed accounts of the doctrines of the Pharisees are to be derived is the Mishna. This is the first portion of the Talmud, and is called by the Jews the Second Law. It is a compendium, compiled or edited by the rabbi Jehudah the Holy, who lived in the second century after Christ. It frequently refers to the opinions of Hillel and Shammai, two rabbis, heads of opposite schools, who flourished before the birth of Christ, and to Gamaliel, the teacher of Paul. It thus establishes a continuity of doctrine or tradition extending over this period. The fundamental principle of the Pharisees is that of the existence of an oral law to complete and explain the written law. 'Moses,' says the Mishna, 'received the law (the unwritten law is meant) from Sinai, and delivered it to Joshua, and Joshua to the elders, and the elders to the prophets, and the prophets to the men of the Great Synagogue.' This principle has all the conveniences and inconveniences of the apostolical tradition and succession of the Roman Catholic Church, and its development bears a striking analogy to that of Romish tradition. The authoritative tradition of the Pharisees received in process of time additions which were not pretended to be derived directly from Moses. In Dr. Smith's Bible Dictionary these are

classified under three heads:—1st. Decisions of the Great Synagogue by a majority of votes on disputed points. 2d. Decrees made by prophets and wise men in different ages. Of these some illustrations will afterwards be given. 3d. Legal decisions of proper ecclesiastical authorities on disputed questions. These authorities comprehended both the writers of the sacred books and their approved commentators, as Hillel and Gamaliel. There was thus a continuously growing tradition, which, being of an authoritative nature, was irreversible; and the multiplicity and minuteness of the regulations it contained reduced men to the rank of children, without the power to use hand or limb except according to order.

The encroaching nature of these regulations may be estimated by the statement of the principle on which the authority of the decrees of the wise men was founded. It was called making a 'fence for the law.' Thus, if anything was forbidden in the moral or ceremonial law, the wise men took occasion to forbid what they thought might lead to it, in order to keep men far from transgression. The prohibition in Exodus and Deuteronomy to seethe a kid in his mother's milk, has thus been gradually extended until it has come to preclude partaking of milk along with or even within several hours of the eating of animal food, not excepting poultry.

The extent and minuteness of these regulations necessarily produces collision among the authorities, and to read the accounts of their various decisions is, with the mere transference of terms, exactly like reading a chapter of Pascal on the casuistry of the Jesuits. Even the prophet Elijah himself, it is said, could not take away anything from the eighteen points which had been determined on by the school of Shammai and the school of Hillel. But these celebrated schools had their differences, and one of the momentous questions on which they disputed was whether an egg might be eaten which was laid on a festival. Both were agreed that if a bird which was not to be killed laid an egg on a festival it could not be eaten, but if the fowl which laid the egg was to be killed the school of Shammai permitted the egg to be eaten, while the school of Hillel refused to permit it. But why was the eating of the egg prohibited at all? Because in Exod. xvi. 5 the people who gathered manna were ordered to prepare on the sixth day what they brought in for the seventh, hence it was held unlawful to prepare food on a Sabbath for a feast-day, or on a feast-day for the Sabbath. Now, an egg was held to be 'prepared' the day before it was laid, and as some feast-days followed the Sabbath, the egg laid on the feast day might have been prepared on the Sabbath, and to avoid this risk of offence it was deemed expedient to prohibit the eating of eggs laid on feast-days altogether. A multitude of regulations were laid for Jewish slaughter-men, and the eating of meat slaughtered by heathens was altogether prohibited. Debts due to a heathen were not to be paid within three days of a Jewish festival, and a Jewish midwife was forbidden to assist a Gentile mother.

To observe these regulations the Pharisees formed a society, which was strictly bound by reciprocal engagements to their common policy. Each member on joining it undertook before three members to remain faithful to the laws. One of the cardinal injunctions was to refrain from buying, selling, or eating anything that was not to be tithed, and to avoid any risk of this the members were forbidden to eat and drink with the people of the land, as the uninitiated, especially of the lower orders, were called.

A special distinction of the Pharisees, which is implied in what has been already said, was the respect they paid to the rabbis or doctors of the law. The orthodox modern Jews who respect the authority of the Talmud are still under the second law prescribed by the Pharisees.

PHARMACOPŒIA (from Greek, *pharmakon*, medicine, *poieia*, to make), a book containing the prescriptions for the preparation of medicines recognized by the general body of practitioners. Up till 1863 separate Pharmacopœias were issued by the Colleges of Physicians of London, Edinburgh, and Dublin. Since then a British Pharmacopœia, issued by the medical council of the kingdom, is recognized by the whole medical profession of Great Britain.

PHARMACY, PHARMACEUTICS (Greek, *pharmakon*, drug), the art of preserving, preparing, compounding, and combining substances for medical purposes; the art of the apothecary. As these substances may be mineral, vegetable, or animal, theoretical pharmacy requires a knowledge of botany, zoology, and mineralogy; and as it is necessary to determine their properties, and the laws of their composition and decomposition, of chemistry also. In a narrower sense pharmacy is merely the art of compounding and mixing drugs according to the prescription of the physician. The preparation of medicines was at first performed by the physicians themselves, who also administered them to their patients; and it first became a distinct branch of medical science at Alexandria towards the beginning of the fourth century B.C., when some physicians devoted themselves solely to it. Afterwards it became the employment of particular individuals (*rhizotomists*, simplers), and the medical science and the apothecary's art thus became separated from each other. Mantias, a pupil of Herophilus, in Alexandria, seems to have been the author of the first Pharmacopœia, having published a work on the preparation of medicines. Zeno of Laodicea distinguished himself by the invention of a large number of compound medicines. Princes also studied the medical sciences, particularly in reference to the preparation of poisons and antidotes. Thus, Attalus, last king of Pergamus (B.C. 134), was noted for his medical skill and his knowledge of plants, and several preparations which he invented are known to us; as, for instance, an ointment of white-lead or ceruse, &c. Mithridates, king of Pontus (123–62 B.C.), invented an antidote composed of fifty-four ingredients. Heras, of Cappadocia, wrote a work on pharmacy at Rome (B.C. 49). Musa, the celebrated physician to Augustus, prescribed several medicinal preparations, which afterwards continued in use under his name. A large collection of compound medicines is enumerated in the works of Scribonius Largus (A.D. 43). Menecrates, physician to Tiberius, was the inventor of the diachylon or litharge plaster. Damocrates (A.D. 47) invented and described in verse the preparation of several medicines, tooth-powder, ointments, &c. Philo of Tarsus (A.D. 23) discovered a sedative composed of opium, saffron, and other ingredients, and called from him *philonium*. Æsclepiades Pharmacion (in the time of Trajan, A.D. 97) prepared several celebrated medicines. Dioscorides, who probably flourished in the reign of Nero (A.D. 34) is distinguished for his knowledge of the properties of plants, and first exposed the fraudulent practices made use of in the composition of several medicines, and prescribed the preparation of some new ones; as, for instance, of ceruse, calamine, flowers of zinc (*nihil album*), &c. Pliny the Elder (79) also rendered important services to pharmacy by his researches in natural history. In Galen's time (160–200) several physicians in Rome employed themselves in the preparation of cosmetics. When, with the decline of the Roman Empire, science and learning became extinct in Western Europe, superstition and blind empiricism

prevailed in the medical department, and pharmacy made no progress. But in the East, particularly in Alexandria, where art and science continued to flourish, chemistry and pharmacy were cultivated with ardour by the Arabians. They studied the works of the Greek writers, and from them we derive many important improvements in the pharmaceutic art. The Caliph Almansor (754) founded in Bagdad the first public *apotheca* or druggist's shop. The names of several medicines, such as alcohol, julep, &c., are of Arabian origin, and it is most probable that we owe to them the first official dispensatories or pharmacopœias. (See PHARMACOPŒIA.) Sabor Ebn Sahel, about the middle of the ninth century, published a pharmacopœia, and in the twelfth century Abul Hassan, physician to the Caliph of Bagdad, published a similar work, which subsequently served as the standard work of the Arabian apothecaries. The Arabian apothecaries' shops were under the particular direction of the government, and were subjected to a strict supervision, particularly in regard to the quality and price of drugs. It is related of Affhin, an Arabian general, that he examined in person the medicine chest of his army, to see if everything mentioned in the dispensatories was provided. With the revival of medical science in the West arose the celebrated school of Salerno. The apothecary's trade was now (in the thirteenth century) regulated by law, and apothecaries and grocers were obliged to sell their articles at fixed prices. Apothecas or apothecaries' halls could be established only in certain places, and two men of standing were appointed in the large towns to superintend them. The most important medicines were compounded under their inspection, and frauds were severely punished. There is a work by Saladin of Ascoli, physician to the Grand-constable of Naples, in the fifteenth century, which, besides other curious materials relating to the state of the apothecaries' trade at that period, contains a list of the books which an apothecary ought to have, with moral precepts and directions for each month. The principal pharmaceutical work of the middle ages was the Antidotarium of Nicholas Præpositus of Salernum, which was celebrated as early as the twelfth century. In France the apothecaries' halls were first subjected to the supervision of the medical faculty in the fifteenth century. In Germany the apothecaries were merely dealers in drugs, which they imported from Italy. The physicians also prepared their own prescriptions. In most cities the apothecaries were likewise confectioners, and the magistrates in their contracts with them stipulated for a certain quantity of confectionary to be delivered in the city-hall. The reforms of Paracelsus in medicine (sixteenth century) introduced some changes into pharmacy. Many chemical preparations were adopted, and the use of mineral specifics, as, for example, antimony and mercury, became more common. Still the operations were conducted without reference to scientific principles; but since the middle of the seventeenth century the natural sciences have continued to make great progress, and pharmacy, as well as medicine, has experienced the effects of the improvement. (See APOTHECARY and CHEMISTS.) In pharmaceutical operations the apothecaries' weight is used, in which 20 grains make a scruple, 3 scruples a drachm, 8 drachms an ounce, and 12 ounces a pound. The following abbreviations and signs are used by physicians in writing their prescriptions:—

℔..... pound.
℥..... ounce.
ʒ..... drachm.
℈..... scruple.
Gr. ..... grain.
C..... (*congium*) gallon.
O..... (*octans*) pint.
f. ℥..... fluid ounce.
f. ʒ..... fluid drachm.
♏..... minim.
Gut.... ..... (*gutta*) drop.
Cochl..... (*cochleare*) spoonful.
Cochl. maj. (*cochleare majus*) table-spoon.
Cochl. min. (*cochleare minus*) tea-spoon.
Manip. ..... (*manipulus*) handful.
j. i. ..... one.
ss. ..... half.
āā or ana.... of each.
q. s. ..... (*quantum sufficit*) as much as necessary.
p. e. ..... equal parts.

PHARO, a game. See FARO.

PHARO OF MESSINA. See FARO OF MESSINA.

PHAROS, sometimes used in English for *lighthouse;* in some other languages it is the ordinary term for these edifices. The name is derived from the island of Pharos before Alexandria, which protected the port of that city. On the eastern promontory of the island stood the lighthouse of Alexandria, so famous in antiquity, and considered one of the wonders of the world, built 300 years B.C. It is said to have been 500 feet high. See LIGHTHOUSES.

PHARSALIA, the plains in the neighbourhood of Pharsalus, a town of Thessaly, where Cæsar defeated Pompey B.C. 48. See CÆSAR and POMPEY.

PHARYNGOBRANCHII ('pharynx-gilled'), the name applied to the lowest order of fishes, represented solely by the Lancelet (which see)—*Amphioxus lanceolatus.* The term alludes to the breathing organs of this fish, which are constituted not by gills but by a greatly enlarged *pharynx* (or back part of the mouth), forming a chamber, the walls of which are strengthened by gristly filaments. Between these filaments a series of transverse slits open on each side, whilst the interior of this pharyngeal chamber is lined by a delicate vascular membrane, the surface of which is richly ciliated. The process of breathing is performed by the admission of water through the mouth into the dilated pharynx. This water laves certain free filaments situated on the sides of the throat, passes into the pharynx, and supplies the oxygen for the aeration of the blood contained in its vascular lining membrane. The effete water then passes through the slits in the walls of the pharynx, and thus escapes into the general cavity of the abdomen, whence it is expelled into the outer world through an aperture known as the *abdominal pore,* which is situated on the lower margin of the body. The name *Branchiostoma* ('gill-mouthed'), occasionally given to the lancelet, has reference to the functions of the pharyngeal sac. See ICHTHYOLOGY and LANCELET.

PHARYNX, the term applied to the region included in the back part of the mouth and upper portion of the throat. It is the pharynx which receives the food after it has been duly masticated in the mouth, and which then transfers it to the œsophagus or gullet. The pharynx of a funnel shape, and about 4 inches in length, its walls being chiefly composed of muscular tissue. It is attached superiorly to the basilar process of the occipital bone. Its broadest part lies opposite the hyoid bone. Its lowest boundary is at the cricoid cartilage of the larynx, that is, about the level of the fifth cervical vertebra, where it passes into and becomes continuous with the narrower 'gullet.' It is loosely attached behind to the bodies of the cervical vertebræ by areolar tissue destitute of fatty elements. The internal carotid arteries run close to the sides of the pharynx, whilst laterally the pharynx is also in contact with the internal jugular veins, and with the eighth, ninth, and sympathetic nerves.

The pharynx is composed of three coats—the inner being the mucous layer, the middle a fibrous coat, and the outer a muscular layer. The muscular coat is composed of various distinct muscles, chief among which are the three *constrictor muscles* of each side. The *inferior constrictor* arises from the sides of the cricoid and thyroid cartilages; the *middle constrictor* takes origin from the great cornu or horn of the hyoid bone, from the lesser cornu, and from part of the stylo-hyoid ligament; whilst the *superior constrictor*, situated at the upper part of the pharynx, arises from the hamular process of the sphenoid bone. All of these muscles are inserted into the middle line of the pharynx, which is marked by a white, fibrous, longitudinal line or *raphé*. The *stylo-pharyngeus* muscle of each side is of long and slender shape, and arises from the inner aspect of the base of the styloid process. Its fibres pass between the superior and middle constrictor muscles, and are in greater part inserted into the thyroid cartilage at its posterior border. The *constrictor muscles* of the pharynx contract upon food and cause it to pass downwards to the œsophagus, the action of the *stylo-pharyngei* muscles being to draw the sides of the pharynx outwards and upwards and so to widen the cavity for the reception of food from the base of the tongue. The pharynx forms only part of the mechanism concerned in deglutition, the tongue, the palate, and its arches and muscles (see PALATE) being also intimately concerned in the process.

The *fibrous* coat of the pharynx is sometimes termed the *pharyngeal membrane* or *aponeurosis*. It is situated between the muscular and mucous layers, and is thickest above, growing gradually thinner, and being finally lost as it descends towards the œsophagus. It is attached above to the basilar process of the occipital bone, where it forms the chief support of the pharynx in the situation in which muscular fibres are thin or wanting. Numerous mucous glands are situated on this fibrous layer at the base of the skull. These are glands of racemose or branched and compound kind, whilst simple mucous glands occur uniformly throughout the entire surface of the pharynx lying beneath the *mucous membrane*. The latter structure is continued from the membrane which lines the nose, the *Eustachian tubes*, the mouth, and the larynx. It is invested by a layer of *columnar epithelial cells*, but below the level of the posterior nostrils the columnar cells are replaced by cells of the *squamous* or *pavement* kind.

Seven apertures open into the pharynx. These are, firstly, the two *Eustachian tubes* of the ear—one on each side—which open into the pharyngeal cavity at its upper and posterior portion and near the lower turbinated bones. This portion or space is known as the *sinus of Morgagni*. The two *posterior nares* or hinder openings of the nostrils form the next two apertures, these being situated at the upper part of the front pharyngeal wall. The single aperture opening backwards from the mouth, termed the *isthmus facium*, is the fifth aperture of the pharynx, this opening being placed above the root of the tongue and beneath the soft palate (see PALATE) and uvula, and having the epiglottis situated at its lower margin. The cordiform or heart-shaped *opening of* the *larynx* comes next in order, this latter aperture being guarded by the epiglottis (see LARYNX); whilst, lastly, the *opening of the œsophagus* or *gullet*, into which the pharynx itself is continued, concludes the list of the pharyngeal apertures.

PHASE, the appearance presented by the illuminated portion of the moon or of an inferior planet. In mathematics, the phase of a simple harmonic motion at any instant is the fraction of the whole period which has elapsed since the moving point last passed through its middle position in the direction which is regarded as positive.

PHASIS, a river of Colchis (Transcaucasia, Asiatic Russia), anciently regarded as the boundary between Europe and Asia. It was afterwards held as the boundary line between Colchis and Asia Minor. It rises in a spur of the Caucasus (Moschici), and after receiving the rivers anciently called the Rhion, the Glaucus, and the Hippus, it falls into the Euxine near the ancient town of Phasis. In the early part of its course it was called the Boas. Its modern name is Rion or Rioni. Other rivers were sometimes confounded by ancient writers under the same name with this. The Phasis of Xenophon was the Araxes.

PHEASANT (*Phasianus*), a genus of Rasorial or Gallinaceous Birds, forming the type of the family Phasianidæ. This genus and group are distinguished by the moderate size and compressed form of the bill, the upper mandible being distinctly arched and overhanging the tip of the lower mandible. The upper mandible is naked at its base; the nostrils are placed at the base of the mandible, and are covered by a scale; the cheeks are naked, and together with the region of the eyes are covered by a reddish skin. The wings are short; the tail being long, wedge-shaped, and consisting of eighteen feathers. The three front toes are united by a membrane up to the first joint, and the hinder toe is articulated to the tarsus. The males possess a horny, sharp, tarsal spur. These birds, now forming the favourite breeds of our game, are well-known tenants of our woods and thickets. The food consists of grains, soft herbage, roots, and insects. They are chiefly terrestrial in habits, taking short rapid flights when alarmed. The Pheasants are polygamous, the males and females consorting together during the breeding-time, which occurs in spring. The males assemble and feed together during winter, but each selects his bevy of mates in spring. The eggs are olive-brown in colour, and number twelve or fourteen, the simple or rude nest being formed amid long grass or bushes, and the female performing the entire duties of incubation. The Common Pheasant (*Phasianus Colchicus*), now fully domesticated in Britain but originally a native of Western Asia, is the familiar species. This bird is supposed to have been introduced into Britain from the banks of the Phasis (now the Rion), a river of ancient Colchis, the modern Mingrelia, a district situated on the eastern side of the Black Sea, between lat. 42° and 43° N.; 41° 19′ and 42° 19′ E. lon. This pheasant extends in its distribution over Southern Europe, and is said even to exist in Siberia. It is the Fasiano of Italy and the Faisan of France. The date of its introduction into Britain is undecided. In Edward I.'s time the value of a pheasant was about 4*d*. of the then currency. The pheasant was known to the ancient Greeks and Romans. Jason was reported to have brought it from Colchis in the famous ship *Argo*. Aristophanes notices it, as also does Aristotle and Athenæus. It was in all probability introduced into Southern Europe by the Greeks or Romans.

These birds breed freely in a domesticated state. The pheasant will interbreed with the common fowl, the Guinea fowl, and even with the black grouse; and there are white and pied varieties of the common species. The hybrid produced by the union of a cock-pheasant with the common hen is termed a *Pero*. The female pheasants when old may, like pea-fowl (see PEACOCK), assume the feathers and general plumage of the males. Cases of recorded 'cocks' eggs' may be explained as the occasional produce of these aged females. The 'Ring-necked' Pheasant, so named from the presence round its neck of a white ring, is supposed to be the hybrid resulting from the breeding of the Common Pheasant

with the *Phasianus torquatus* of China. The Golden Pheasant (*P. pictus*, see Pl. CXLVI.-CXLVII. fig. 17) of China is a beautiful species, coloured scarlet, blue, and yellow, and having a brilliant golden erectile crest borne on the head. The Silver Chinese Pheasant (*P. nycthemerus*) possesses a general white plumage, the feathers being marked by fine black lines; the under parts are coloured black. Other species inhabiting Southern Asia and the Eastern Archipelago are the Diard's Pheasant of Japan (*P. versicolor*); Reeve's Pheasant (*P. veneratus*) of China; and Sömmering's Pheasant (*P. Sömmeringii*), also found in Japan. *P. Staceii; P. Pucrasia* (or *Pucrasia macrolophus*) of the Himalayas; *P. albocristatus*, form species more nearly related to the true fowls, which are also members of the great family Phasianidæ. The Tragopan Pheasant (*Ceriornis satyra*), also found in the Himalayas, approaches the fowls. The males of this species possess peculiar bluish horn-like processes borne on the head, and wattles of a similar colour. The male plumage is coloured red with white spots, that of the females being brown. The female Tragopans want the horn-like appendages. The Argus Pheasant (*Argus giganteus*), included by some naturalists in the Peacock group (Pavoninæ), is a large species found in Sumatra, Malacca, &c. The males of this bird measure from 5 to 6 feet from the tip of the beak to the extremity of the tail, which is formed by two elongated central feathers. The plumage is exceedingly beautiful, the secondary quills of the wings, which are longer than the primary feathers, being each adorned with a series of ocellated or eye-like spots of brilliant metallic hues. The general body-plumage is coloured brown. The flight is feeble, owing to the length of the secondary feathers, which latter, however, assist these birds in running.

The Impeyan Pheasant (*Lophophorus Impeyanus*), forming the type of the genus Lophophorus, is found in Nepaul and on the Himalayas. The bill is broad at the base, strong, and elongated; the upper mandible projects greatly over the tip of the lower; and the tail is short, broad, and rounded at the extremity. The male is as large as a turkey, his plumage being coloured black, adorned with beautiful metallic lustres and tints. The head possesses a peculiar tuft or crest of naked-shafted feathers, exhibiting a golden green lustre. The tail is of a chestnut red, the rump being white. The colour of the females is a more sober brown, interspersed with light brown or gray. None of the Pheasant sub-family appear to be represented in America.

PHENOL. This name is applied to a substance obtained from coal-tar by treating the portion which, on the second distillation, boils between 150° and 200°, with potash-ley, dissolving the solid magma thus formed in water, removing the oil which then rises to the surface, neutralizing the lower alkaline liquid with hydrochloric acid, and purifying the phenol thus obtained. Phenol forms colourless, needle-shaped crystals, which melt at 34° or 35° C., and boil at 187°–188° C. The crystals are very deliquescent; they have the smell of kreasote, and attack the skin like that substance. An aqueous solution of phenol coagulates albumen very readily, and prevents to a great extent the putrefaction of animal matter. The formula of phenol is C_6H_5OH, in which one of the hydrogen atoms is replaceable, although with difficulty, by metals; various chloro-, bromo-, and iodo-derivatives are known, as also bodies in which the hydrogen is replaced by such radicles as NO_2, &c.

PHENOMENON, in philosophy, that which appears; the apparent object of perception or consciousness considered as such, and apart from the consideration of what may be the real object perceived or cognized.

PHENYL (C_6H_5). The substance having the foregoing formula is not known in the free state, but in combination it forms an important series of bodies: thus with hydroxyl it forms phenol (which see), C_6H_5OH; and with amidogen (NH_2) it forms the all-important substance phenylamine, or aniline, $C_6H_5NH_2$. Phenylamine is produced from benzol, which occurs in coal-tar, by the following steps:—

(1.) Formation of nitro-benzol $C_6H_5(NO_2)$.

(2.) Reduction of this substance by nascent hydrogen—

$$C_6H_5(NO_2) + H_6 = C_6H_5(NH_2) + 2H_2O.$$

For an account of the manufacture and properties of this body see the article ANILINE.

PHERÆ, an ancient city of Thessaly, situated in the south-east corner of Pelasgiotis, south of the Lake Bœbeis, 90 stadiæ from Pagasæ, its port. Admetus, and his son Eumelus, are related to have led eleven ships from Pheræ and the neighbouring towns to the Trojan war. Pheræ assisted the Athenians in the Peloponnesian war. The government was then aristocratic, but before the conclusion of the Peloponnesian war a tyranny had been established at Pheræ by Lycophron. His son Jason was elected Tagus or military commander of Thessaly about B.C. 374, in which office he was succeeded by his brothers Polydorus and Polyphron. The supreme power continued in the same family notwithstanding the repeated assassination of its head by some of the members, until another Lycophron was deposed by Philip of Macedon, and Pheræ with the rest of Thessaly subjected to his power. In the middle of Pheræ was the celebrated fountain Hypereia.

PHERECYDES, a celebrated sage of ancient Greece. He is regarded as the first who wrote in prose on philosophy and religion, although his expression, as is natural, inclines much to poetry. He was a native of the island of Syros, flourished in the sixth century B.C., and was a contemporary of Thales. The fragments of his work on nature and the gods are merely allegorical thoughts. Sturz collected them (second edition, Gera, 1798). Pherecydes considered Zeus or Aither, Time or Chronos, and the Earth, which he esteemed a chaos, as the elements of all things. He is said to have taught the doctrine of Metempsychosis, or of the immortality of the soul. He is generally stated by ancient writers to have been the instructor of Pythagoras.

PHIDIAS OF ATHENS, a celebrated Greek sculptor, who was born about 490 B.C., and flourished in the age of Pericles. According to Böttiger, Phidias executed three statues of Athena which were all in the Acropolis in the time of Pausanias. One colossal statue of Athena he cast in bronze (taken from the tenth of the spoils won on the plains of Marathon), for the temple of Athena Polias, in which she was represented as a guardian deity. Mys wrought upon her shield, in relievo, the battle of the Centaurs, from designs by Parrhasius. Near the statue stood the primitive possessor of the mount, an owl. It is related of this statue that mariners, doubling the promontory of Sunium, saw her crested helmet and the point of her spear. The second of his most famous statues was made of ivory and gold. It was denominated the statue of the Parthenon, or the Parthenos (the virgin), and measured, with the pedestal, about 41½ English feet in height. Instead of marble he made use of ivory, which admitted of a much softer and more brilliant polish. It was in reality formed of wood, overlaid with ivory. He threw over it a garment of gold, either beaten or cast with such exquisite skill that it might be put off or on at pleasure, and could be weighed at any time by the treasurer of the temple, which afterwards

enabled him to refute the charge of peculation. The gold was taken away by Lacharis in 296. It weighed 44 talents. The eyes were of marble, let in and probably painted according to the prevailing custom. The goddess stood upright, with the ægis on her breast and a spear in her left hand. There was likewise an immense serpent or dragon near her, supposed to be that of Ericthonius. In her right hand was the goddess of Victory, formed in like manner of ivory, with a vestment of gold, 4 cubits high. By her side stood the great shield, representing on the convex side the battle of the Amazons, and on the concave the battle of the Titans. The different parts of the statue, as well as the pedestal, were wrought in relievo. Thus, for example, Phidias introduced himself and Pericles on the shield. The third statue, in bronze, of a smaller size, which was called emphatically the *beautiful*, on account of its exquisite proportions, was purchased by the people of Lemnos, and sent by them to the Acropolis of Athens. The Olympian Zeus of Phidias represented the serene majesty of the king of heaven, and was ranked for its beauty among the wonders of the world. Zeus was here seen sitting upon a throne, with an olive wreath of gold about his temples; the upper part of his body was naked; a wide mantle, covering the rest of it, hung down in the richest folds to his feet, which rested on a footstool. The naked parts of the statue were of ivory, the dress was of beaten gold, with an imitation of embroidery painted by Panænus, brother of Phidias. In the right hand stood the goddess of Victory, turning towards the statue, and carved, like it, out of ivory and gold; she was holding out a band, with which she appeared desirous to encircle his olive crown. In his left hand the divinity held a parti-coloured sceptre, made of various metals skilfully joined, and on the sceptre rested an eagle. Power, wisdom, and goodness were admirably expressed in his features. He sat with the air of a divinity, presiding among the judges of the games, and dispensing the laurel wreaths to the victors, calm in conscious dignity, the *beau idéal* of Greek anthropomorphism. Cicero (De Oratore, ii.) relates that the artist was led by a passage in the Iliad to imagine such a figure. The statue was surrounded with magnificent drapery, which was drawn aside only on particular occasions when the deity was to be exhibited. A sense of greatness and splendour overwhelmed the spectator. The Zeus was removed to Constantinople by Theodosius I., and was destroyed by fire in 475. From Phidias that elevated style which is so much admired is commonly supposed to have been derived, and modern antiquarians maintain that after his death Grecian art began to decline. Phidias was, moreover, an architect. By the exertions of Pericles Athens was made the most magnificent city in Greece. During his government, which lasted twenty years, the city was adorned with more costly temples, colonnades, and other works of art, than Rome, though mistress of the world, could boast in seven centuries. Every one was anxious to do something for the ornament of the city of Athena. The best materials and most skilful artists were there in abundance. Phidias superintended these improvements; and the sculptures with which the Parthenon, for instance, among other buildings, was adorned, were partly his own work, and partly in the spirit and after the ideas of this great master. Phidias received great honours from the Athenians, for whose fame he was labouring, while Pericles had the sovereign power; but he was subjected to a change of fortune when the popularity of his patron declined. He was first accused of peculation, and then of impiety for putting his own likeness and that of Pericles on the shield of Athena. He died in prison before B.C. 432. The cause of his death is unknown. See C. O. Müller, De Phidiæ Vita et Operibus, &c. (the Life and Works of Phidias; Göttingen, 1827, 4to), Preller's article Phidias in Ersch and Gruber's Encyclopædia, &c.

PHIGALIAN MARBLES. The town of Phigalia, situated near the Messenian border, in the south-western extremity of Arcadia, experienced the usual vicissitudes of Greek cities through external wars and internal factions, till it fell under the power of Macedon. The district in which Phigalia lies is almost completely surrounded by a mountain-range, which, beginning in the territory of Elis, and crossing the border of Arcadia in an easterly direction, turns south across the Messenian border, and running west again almost completely incloses the south-west corner of Arcadia in which the city lies. On one of these mountains, Mount Cotilium, to the north-east of Phigalia, was situated the temple of Apollo Epicurius, built at the time of the Peloponnesian war by Ictinus, the architect of the Parthenon at Athens. It was erected as a memorial of the gratitude of the Phigalians for the relief afforded by Apollo from a plague which afflicted them during this war, and in consequence of which he received the surname of Epicurius. In the quality of stone and excellence of workmanship it is said to have excelled all the temples of Greece, with the exception of one of Athena at Tegea. It still remains entire, and except the Theseium at Athens is the best preserved temple of Greece. It stands in a rocky glen near the summit of the mountain, surrounded by ancient oaks, and commanding a splendid view of the surrounding country. It remained unknown till it was visited by Chandler in 1765. In 1812 an extensive investigation of the temple and its site was made by a group of scientific explorers. It is built of a close-grained finely veined limestone. A thick wood of oaks covered the acclivity by which it was approached, and had long concealed the temple from view. This exploration resulted in the discovery of rich treasures of sculpture and architecture. The temple presented some peculiarities. Its orientation was north and south, instead of east and west, as is common in Grecian temples. The frieze, which was usually on the exterior of the temple, was here in the interior, and with the Metopes was of Parian marble. In the inner temple was erected a colossal statue of Apollo Musagetes, in a flowing white tunic and with a lyre in his hand. The friezes, which were the glory of the temple, consisted of twenty-three bass-reliefs, measuring 2 feet 2½ inches in height. Twelve of them represented the contests between the Amazons and the Athenians, eleven those between the Centaurs and the Lapithæ. These friezes were purchased in 1814 for £15,000 by the British government, and having been removed from the temple are now in the British Museum.

PHILADELPHIA, a city of the United States, in Pennsylvania, next to New York the largest city in the American Union, 125 miles north-east of Washington, and 85 miles south-west of New York, situated on the west bank of the Delaware at the mouth of the Schuylkill, 96 miles from the Atlantic coast. The original city occupied an area of little more than a mile from north to south, and two miles from east to west, bounded on the east by the Delaware, and on the west by the Schuylkill, but in 1854 the boundaries were made coextensive with those of the county of the same name, and the city has now the largest area of any in the Union. The more densely built part of it covers about 15 square miles. The district west of the Schuylkill is known as West Philadelphia, and the municipality comprises several other places, such as Germantown, Chestnut Hill, Frankford, Manayunk, Bridesburg,

and Holmesburg, which have nearly all the character of separate towns, and still retain the names they bore previous to their incorporation with Philadelphia. The area of the municipality is now about 130 square miles, and the city has a frontage along the course of the Delaware of 23 miles. Much of the surface near the rivers is low and flat, but towards the north and west it is undulating and somewhat broken. The streets were originally laid out so as to run nearly due westward from the Delaware, intersected by other streets running nearly east and west, but this plan, though generally conformed to in the newer quarters, had to be modified owing to the configuration of the site as determined by the curves of the rivers. Still almost everywhere the streets cross each other at right angles. Several irregular avenues, at one time the suburban and country main roads, stretch away from the original town plot. Market Street, the great central street running east and west, and continuously built upon for over four miles, has a width of 100 feet; Broad Street, the principal central street running north and south, is built upon to about the same length, and is 113 feet in width. Most of the other chief streets vary from 50 to 66 feet broad, some of the avenues, however, being much wider. Some of the blocks made by the intersection of the streets, instead of being built upon are formed into open squares; among which may be mentioned Independence Square, laid out in shady walks and grass-plots; Washington Square, affording an elegant promenade; and Franklin Square, with a magnificent fountain in its centre. Penn Square, one of the original city squares, is now occupied by the new city-hall. Many of the streets are well planted with rows of trees; all of them are well cleaned, lighted with gas, and abundantly supplied with water, while the principal thoroughfares are laid with the lines in connection with an efficient system of tramways. Several fine bridges, both for railway and general traffic, span the Schuylkill, the more noteworthy being that at Girard Avenue in Fairmount Park, a light and handsome iron structure 1000 feet long and 100 feet broad; the Spring Garden or Callowhill Street bridge, also of iron and having an upper and a lower roadway 1290 feet long; and the iron and stone bridge at Chestnut Street, 1528 feet long. A regular system of ferries over the Delaware affords communication with the shores of New Jersey.

In the early period of the city's history the building material used was almost exclusively a brownish red brick for which Philadelphia was noted; the resulting monotony was subsequently remedied by the houses being ornamented with marble facings, and steps of the same material. The chief business streets are now lined with a large number of costly and superior edifices of white and blue marble, granite, sandstone, and iron. Among the public buildings the first notice is due—more, however, on account of its antiquity and historical associations than its architectural merit—to the State House, with the large eastern room of the lower floor, called Independence Hall, from the circumstance that the famous declaration of independence was signed here (4th July, 1776). The custom-house is a white marble edifice, fronting both on Chestnut and Library Streets; the United States mint is a marble-fronted building in Chestnut Street; the new post-office is a magnificent granite structure with fronts on Chestnut, Ninth, and Market Streets; the new city-hall, the largest building in the States, is built in the French Renaissance style, at the corner of Market and Broad Streets. Other public buildings worthy of mention are the Commercial and the Merchant's Exchanges, the Masonic Temple, the "Public Ledger" buildings, the publishing house of Lippincott & Co., the Eastern Penitentiary, the United States arsenals, the permanent exhibition buildings (which were the largest of the structures erected for the Centennial Exhibition of 1876), with the annexed Memorial and Horticultural Halls; together with numerous magnificent hotels and club-houses; extensive banking, insurance, and other business premises, many of which are of considerable architectural merit.

Among the prominent ecclesiastical buildings may be mentioned the Episcopalian churches of St. Peter's, St. Mark's, the Holy Trinity, Christ Church, and the Church of the Incarnation; the Presbyterian churches in West Arch Street, Washington Square, the Calvary, and the Second Church; the Beth-eden and First Baptist Churches; the Central Congregational Church; the Arch Street Methodist Episcopal Church; the Lutheran Church; the Roman Catholic Cathedral of St. Peter and St. Paul, the Jewish Synagogue, &c.

At the head of the educational establishments of the city is the Pennsylvania University, housed in spacious and elegant buildings, including medical, scientific, legal, and art schools, and having under its management a commodious hospital. The Jefferson Medical College (with hospital) is one of the best attended schools of its class in the Union. There are also several colleges of pharmacy and dentistry, homœopathic schools, the Woman's College, a polytechnic college, &c.; the Academy of Fine Arts, the School of Design for Women; the Academy of Natural Sciences, the Zoological Society, the Franklin Institute, the Wagner Free Institute, the Horticultural, Philosophical, and Entomological Societies, &c.; numerous colleges, academies, and other educational institutions, supported by the various religious denominations; the Girard College, devoted, according to the will of its founder, exclusively to the secular education of orphan boys; over 200 public schools (attended by more than 100,000 pupils) at the head of which are the boys' high school and the girls' normal school. Many of the above institutions possess extensive and valuable libraries, in addition to which are the collections of 130,000 vols. belonging to the Library Company, and of 140,000 vols. belonging to the Mercantile Library. Connected with the principal scientific institutions are interesting and valuable museums, cabinets, and collections of objects connected with the branches of learning studied by their members. Besides the art collections belonging to the Academy of Fine Arts, and kindred institutions, there are in the city some of the finest picture galleries to be found in the country, and Philadelphia is one of the recognized centres of literary, dramatic, and artistic culture.

Few cities are so munificently supplied with efficient charitable institutions. We can only mention the Episcopal, Presbyterian, and Roman Catholic hospitals; about 25 homes for the sick (mostly private and denominational); the Municipal, German, Wills, Christ Church, Pennsylvania Insane, Charity, Jewish, Children's, Women's, State, and other hospitals; the Friends' Insane Asylum, the Preston Retreat, and upwards of 20 orphanages and children's homes, besides numerous dispensaries, and organized societies for the relief of distress, poverty, and sickness, under both general and denominational supervision.

In addition to the public squares already referred to, the chief place of out-door recreation is Fairmount Park, with an area of 2740 acres, possessing much natural beauty, being well-wooded and having a great variety of surface. The principal places of indoor amusement are the theatres (at the head of which is the Academy of Music), numerous concert-rooms, &c.

Accessible from the Atlantic by the largest mer-

[illegible] manufactures in iron and steel, with the exception of the state and having the extensive [illegible] of many important railway systems. Philadelphia stands high as a centre of foreign trade and coasting trade. The leading articles of export are [illegible] petroleum, [illegible] and [illegible] iron and iron-ware, lumber, [illegible] and [illegible] raw and manufactured. The principal imports consist of [illegible] wool and fine goods, [illegible] iron and iron-ore, [illegible] and medicines, &c. The total value of imports by sea in 1881 amounted to £[illegible], and exports £[illegible]. The most important import and export trade is with Great Britain, from which we import [illegible] fabrics, [illegible] and [illegible] goods, [illegible], &c. Lines of steamers connect Philadelphia with Liverpool, Antwerp, the West Indies, and the greater number of the important ports of the United States. Philadelphia is the first manufacturing city in the United States. According to an official statement made in 1882, the manufacturing establishments numbered [illegible], employed nearly [illegible], and turned out products of the aggregate value of £[illegible]. Since 1870 there has been a [illegible] increase and development of manufactures, the production of textile fabrics, for instance, having been more than [illegible] in every department. The other leading manufactures are iron and steel, machinery and tools, refined sugar, clothing, boots and shoes, brewery products, chemicals, household furniture, &c.

Philadelphia was founded and named by William Penn in 1682 as the capital of his colony of Pennsylvania. Owing to the wisdom of its founder, and his strict observance of equity in dealing with the neighbouring Indians, the city had comparatively few obstacles to struggle with, and, possessing in its site advantages of which few cities can equally boast, made rapid progress. In 1683 and the following year large parties of emigrants arrived from Germany and Holland as well as from England and Wales. They nearly all belonged to the Society of Friends, and the city continued to be almost exclusively occupied and controlled by the members of that denomination for half a century after its foundation. One of the most fortunate events in its history was the selection of it for a residence by Benjamin Franklin, to whose practical sagacity and philanthropy it is indebted for many of its most important improvements. It played a prominent part during the Revolutionary War; the Declaration of Rights having been adopted in it in 1774, and the Declaration of Independence issued from it in 1776. In 1777 it fell into the hands of the British, who occupied it for about nine months. In 1787 the convention which arranged the constitution of the United States met here; and in 1790 the first congress under this constitution, by selecting it for their place of meeting, eventually made it the capital of the Union, which it continued to be till 1800. Between 1793 and 1798 the yellow fever was extremely disastrous, the deaths within the six years being over 12,000. Philadelphia has on several occasions been the scene of very destructive riots. In 1834, 1835, and 1838 attacks were made on the abolitionists, and Philadelphia Hall, their meeting-place, was burned down. During the Anti-Catholic riots of 1844 many lives were lost and much property was destroyed. In May November, 1876 (a hundred years after the issue of the Declaration of Independence), the Centennial Exhibition was held on grounds at the south west extremity of Fairmount Park, and proved one of the most successful international exhibitions hitherto held in any country. Pop. (1870), 674,022; (1880), 847,170.

PHILADELPHUS. See the end of the article Ptolemy.

PHILAE, or Philæ in Egypt, that is, Temple Island, a small island of the Nile, on the borders of Nubia and Egypt, in 24° 1′ N. lat., immediately to the south of Elephantine or Syene. It contains some remarkable monuments of the ancient Egyptians, among which are several temples, an avenue of majestic columns, several obelisks, a monolithic temple, &c. The temples are in the highest state of preservation of any in Egypt. The entire island is only about 1250 or 1300 feet in length and 450 in breadth; it is sufficiently high to escape the greatest inundations, and is dominated by a granite rock at its southern extremity, which affords an excellent view of the entire island with its various monuments. There are eight temples altogether, built at different times and dedicated to different religions. The most ancient is a temple erected by Nectanebos I., the last of the native Pharaohs, about 378–360 B.C. It is modern, and but for the sculptures would not be taken for a temple. There is also a great temple to Isis, built by Ptolemy II., Ptolemy III., and Energetes, 247–222 B.C. Others are of the times of the Ptolemies and Cæsars. In the eastern part of the isle is a triumphal arch of the time of Diocletian. From the numerous inscriptions on these monuments it appears that the worship of Isis was maintained in the island till the fifth century of the Christian era. There was a college of priests in it in 453. In 577 Bishop Theodore placed the temple of Isis under the protection of St. Stephen. Christianity was subsequently replaced by Mohammedanism.

PHILAGRIUS, a Greek physician who is supposed to have lived in the third century B.C. He appears to have been well known to Arabian medical writers, who frequently quote him. Only fragments of his works are now extant.

PHILEMON, Epistle of Paul to. This epistle, according to the prevalent opinion, was, together with the Epistles to the Ephesians, Colossians, and Philippians, written from Rome during St. Paul's first imprisonment in that city. The only doubt thrown on this opinion by those who accept the genuineness of the epistles is contained in the suggestion supported by Meyer and others, that these epistles were written during the apostle's imprisonment at Cæsarea. Those who oppose this view, among other objections, consider it very doubtful that the apostle then had liberty to preach, as it is stated in the Acts of the Apostles that he had at Rome, and as he appears in these epistles to indicate that he had at the time they were written. The genuineness and authenticity of Philemon is questioned by very few critics. Baur, however, makes it the production of a later writer, and gives it a fictitious character, attributing it to a design to illustrate the operation of Christianity in the supposed circumstances. The Epistle to Philemon has a special interest, as illustrating the attitude assumed by the early Christians, and particularly by the apostle Paul, in relation to the institution of slavery. It has also been much and justly admired in an æsthetical point of view. There is extant a letter of the younger Pliny interceding with a friend on behalf of a fugitive slave, which has been compared by various scholars with the epistle of Paul, greatly to the advantage of the apostle, whose tact and delicacy in this epistle could hardly be exceeded.

PHILEMON and BAUCIS, a pair celebrated in ancient Greece for their faithful affection even in advanced age. Fable (Ovid's Metam. viii.) relates the following story concerning them. Jupiter and Mercury travelling through Phrygia in a human form found no one willing to entertain them except this aged couple, who received them hospitably,

washed their feet, set before them a rustic meal, and prepared a couch for their repose. The deities then took their hosts to a neighbouring mountain, and when they looked behind them they saw their village sunk beneath the waves; but the cottage in which they had welcomed the pilgrims had become a magnificent temple. Jupiter promised also to fulfil all their wishes; but they only asked that they might die together as servants in that temple. At length, at a very advanced age, as they sat at the temple door they were at once transformed, Philemon into an oak, and Baucis into a linden. They were conscious of their change, which came gradually upon them, and while they were able to see and speak they took the most affectionate leave of each other. The trees were considered sacred, and long remained before the temple.

PHILEMON OF ATHENS, a Greek comedian, was born about 360, began to exhibit about 330, and died about 262. He shares with Menander the honour of originating the new comedy. He was a few years earlier than Menander, but inferior to him in genius, though a greater favourite with the Athenians. The fragments of his plays extant are usually printed with those of Menander.

PHILIDOR, François André Danican, was the grandson of Michael Danican, a hautboy player of the court of Louis XIII., to whom the courtiers had given the surname of *Philidor*, because he reminded the king of a celebrated Italian player named Filidori. All the family, which produced numerous musicians and composers, afterwards took the name of Philidor. André Philidor, as he was usually called, was born at Dreux in 1726. At six years of age he was admitted through the influence of his family among the children of the chapel of Louis XV. He had here the advantage of the instructions of André Campra, one of the ablest French musicians previous to Rameau. While in the service of the chapel he learned to play at chess, which divided with music the interest of his life, and to which he chiefly owes his fame. The musicians were in the habit of playing chess in the ante-room while waiting for the arrival of the king to sing mass. Philidor had long watched them, when one day an old player chancing to arrive early lamented the want of an opponent. Philidor, then about ten years of age, offered to play, beat him, and on giving check-mate immediately fled from the room in dread of corporal chastisement. At twelve years of age he had played before the king a motet with choruses of his composition, on which the king highly complimented him, and gave him a present of 10 louis. When he had finished his education he began to pursue his profession in Paris, but was compelled to eke out a living by giving lessons at miserable fees, and even by copying music. At this time he made the acquaintance of some of the leading chess-players, and excited much surprise here, and afterwards in England, by playing without seeing the board, then an unknown accomplishment, although the playing of several games simultaneously in this way is now hardly a rarity, even among provincial players, and as many as ten or twelve have been successfully attempted against good players by Paulsen, Morphy, Steinitz, Zuckertort, and others. It is amusing to read of Philidor's health suffering from these severe exercises, for which he had to prepare himself by extraordinary abstinence. Debt at length compelled him to go abroad. He went first to Holland and Germany, where he played with the best players, and published in 1748 his Traité des échecs. After visiting the English camp at Maastricht, and playing with the Duke of Cumberland, he went to England, where, by means of a subscription made for him by the duke, he published his Analyse du jeu des échecs. His stay in England was prolonged till 1754. While here he set Dryden's Alexander's Feast to music. In 1754 he returned to Paris, and, together with Duni, Monsigny, and Grétry, he contributed to found the comic opera, for which he wrote many charming pieces. His operatic career was a great success. His pieces, which were numerous, were warmly received by the public, and several of them are still regarded as master-pieces of their kind. Having been pensioned for his services by the Comédie Italienne, he abandoned musical composition in 1788 in order to give himself up entirely to his passion for chess. In 1792 he settled in London, not, as has been alleged, as an émigré, but simply as a chess-player attracted by a pension from the London Club. He died in London in 1795. Philidor bears the reputation of having been the first chess-player of his day. He attempted innovations on the theory of the game, but his notions seem to have been narrower than those of the great Italian players who preceded him as *doctrinaires*. He substituted an opening which bears his name, the Philidor defence, for the *giuoco piano* of the Italians, which he condemned on insufficient grounds. Although his opening, which is technically styled a close one, has been greatly improved in modern practice, and is still played, it cannot compare in interest or value with the Italian open game, or even with other close games, as the French game or the Sicilian. His chess works and collections of games played by him are much valued for their antiquarian and historical interest.

PHILIP II., King of Macedon, the youngest son of Amyntas II. and Eurydice, was born B.C. 382. He passed a portion of his early years in Thebes. The explanations of this circumstance are numerous and conflicting. It seems probable that he was brought thither by Pelopidas either as a hostage or for his own security. His education in Thebes seems to have been of a practical kind. On the death of his brother Perdiccas III., who was slain in battle against the Illyrians B.C. 360, he became the supreme ruler of Macedonia as guardian of his nephew Amyntas, whom he soon set aside in order to assume for himself the regal title. This measure was probably rendered expedient by the dangers to which the kingdom was then exposed, there being two pretenders to the throne, and threatened invasions by the Illyrians and Pæonians. Philip raised the courage of his subjects, and by his improvements in their military organization prepared them to meet their difficulties. The Thebans had already improved on the Spartan phalanx, and Philip carried it to the highest perfection of which it was susceptible. He purchased peace from the Pæonians. Argæus, one of the pretenders to the crown, was supported by Athens, but Philip, having defeated this pretender, dismissed the Athenians with presents, which conciliated the republic, and induced it to send ambassadors to renew the alliance between the states which had existed in the time of Philip's father. Peace was concluded B.C. 359. Philip then conquered the Pæonians, and having defeated the Illyrians forced them to accept a peace on the condition of a cession of territory. He now began to adopt an aggressive policy, which excited the enmity of the Athenians; but his subtlety was equal to his ambition, and he neglected no means to allay the suspicions of the different powers threatened by his conquests, and skilfully availed himself of their divisions and jealousies to prevent them from combining against him. Thus he secured Amphipolis, which he had formerly abandoned to propitiate the Athenians, on the pretext of delivering it up to them, and afterwards found another pretext for retaining it. He took Pydna and Potidæa (B.C. 356), and a settle-

ment of the Thasians, which he named Philippi. The last acquisition put him in possession of valuable gold mines. During the Social war, B.C. 357–355, he remained comparatively passive. Even Demosthenes does not appear at this time to have suspected the extent of his ambition. In B.C. 354 he took an opportunity to form a Macedonian party in Eubœa. He now turned his eyes to the Chersonesus, but did not at once find an opportunity for taking a decisive step in that direction. The Sacred war (see GREECE, ANCIENT) afforded him an opportunity of interfering in the affairs of Greece, of which he availed himself, and in the siege of Methone (B.C. 353) he lost an eye. This war again involved Philip with Athens, and in B.C. 352 Demosthenes pronounced his first oration against him. The immediate object of the Sacred war was accomplished by the subjugation of the Phocians. After campaigns in Thrace and Epirus in B.C. 349 he attacked the Chalcidian cities, and in B.C. 348–347 besieged and took Olynthus, the inhabitants of which he sold for slaves. The Athenians now attempted to form a coalition against him, but, failing, entered into an alliance with him. Philip next endeavoured to form a league in the Peloponnesus against Sparta, which was in vain opposed by Athens. This gave rise (B.C. 344) to the second Philippic of Demosthenes. In this year he took steps to complete the subordination of Thessaly. The Athenians were at length provoked to open resistance, and in B.C. 339 they compelled Philip to raise the siege of Perinthus and Byzantium. But their success was short-lived, and the battle of Chæronea (B.C. 338) put the whole of Greece at the mercy of Philip. After this victory he behaved more magnanimously to the Athenians than to the Thebans. Philip's ambition had long extended to the invasion of Persia, and he had now the means of accomplishing it within his reach. A congress was held at Corinth, to which all the states of Greece but Sparta were invited. At this congress the war with Persia was determined on, and Philip appointed commander of the confederate forces. After a campaign against Sparta, in which he compelled her to surrender various portions of her territories to his allies, he returned to Macedon B.C. 338, and began active preparations for his expedition to the East. Next year he married Cleopatra, the daughter of Attalus, one of his generals, which caused a breach between him and his son Alexander. In B.C. 336 he celebrated with great pomp the marriage of his daughter Cleopatra with his brother-in-law Alexander of Epirus, by which he hoped to heal this division, but he was assassinated during the feast by a Macedonian youth, Pausanias, who had a private grudge against him. Alexander and his mother Olympias were suspected of complicity in the plot. His death occurred after midsummer. Philip had many of the virtues of a great ruler. He was crafty as well as bold in his measures. He was a lover of pleasure, and had many wives; but he could practise severe self-denial when he had an object to accomplish, and he was habitually magnanimous, not only from policy but from inclination. He was a liberal patron of science and literature, and his natural eloquence was of no small service in promoting the objects of his ambition.

PHILIP II., AUGUSTUS, King of France, born 1165, was crowned as successor during the lifetime of his father Louis VII., whom he succeeded in September, 1180. In April of the same year he had married Isabella of Hainaut. One of his first measures was the banishment of the Jews from the kingdom, and the confiscation of their property. This was done under pretence of their being guilty of various crimes; but the real purpose of the measure was to get possession of their wealth. Philip next endeavoured to repress the tyranny and rapacity of the nobles, which he effected partly by art and partly by force. In 1190 he embarked at Genoa on a crusade to the Holy Land, where he met Richard Cœur de Lion (see Richard I.), who was engaged in the same cause in Sicily. (See CRUSADES.) The jealousies and disputes which divided the two kings induced Philip to return home the next year; and he took advantage of Richard's imprisonment in Austria to seize some of the English fiefs in Normandy. This enterprise was in direct violation of the oath by which the two princes had mutually bound themselves to attempt nothing against each other's dominions during the continuance of the crusade; and on Richard's delivery he commenced a war against Philip, which continued till the death of the former in 1199. Philip, on his return from the Holy Land, had married Ingeburga, sister of the King of Denmark; but, having taken some disgust at her, he finally procured from his bishops a divorce, under pretence of consanguinity, and married Agnes, daughter of the Duke of Méran. On the complaint of the King of Denmark the pope declared this marriage null; and on Philip's refusing to receive Ingeburga, pronounced the interdict against France.[1] The king was therefore obliged to yield, and restore her the honours of a wife and queen. (See INNOCENT III.) In his subsequent wars with John (of which an account is given in the article JOHN) Philip conquered all Normandy, Touraine, Anjou, and Maine, so that of all the British possessions in France Guienne alone remained. Philip also took part in the crusade against the Albigenses (which see). He died in 1223, after a reign of forty-three years. This prince was an able general and sovereign; he extended the boundaries of the kingdom, and contributed to raise the royal authority from a state of dependence on the great vassals. He improved the military organization of his realm, founded useful institutions, constructed roads, and favoured learning.

PHILIP IV. (LE BEL), King of France, was born in 1268, and succeeded his father in 1285. He had already (August, 1284) married Joanna, queen of Navarre, by which alliance he added Champagne as well as Navarre to the royal domain, which he made it his policy still further to increase at the expense of the great vassals. He even attempted to take Guienne from Edward I. of England, but afterwards entered into an alliance with that monarch, and gave him his daughter in marriage (1299), from which originated the claim of Edward III. on the crown of France. This peace enabled him to unite Flanders, which had been in alliance with England, to the domain of France, while Scotland, the ally of France, was given up to the vengeance of England. Under Philip France had begun to grow into a kingdom. Two-thirds of it were included in the royal domain, justice had to be administered, taxes imposed, and mercenary armies raised for conducting wars which were now too distant and protracted for the feudal troops. The Flemings, unaccustomed to arbitrary rule, revolted in 1302, and defeated at Courtrai a numerous army sent against them by Philip. Philip made vigorous efforts to repair his defeat, raised forced contributions, coined false money, and in two months brought together a numerous army. But although his military operations were attended with some success he was obliged to be contented with the cession of the Walloon territory, restoring the rest of Flanders to its count on condition of feudal homage. Philip had been engaged at the same time

[1] Agnes de Méran died of grief at Poissy in 1201, the year in which she was repudiated. The pope legitimated her two children by Philip, as she was authorized to consider the king free when she married him.

in a violent dispute with Pope Boniface VIII., who reproached him with the oppression of his subjects by arbitrary exactions and false coinage, as well as with encroachments on the rights of the church, the pontiff's real grievance. Philip was supported by the states-general, which he convoked in 1302 and 1303, in maintaining the independence of his kingdom against Boniface's unconditional assertion of the supremacy of the spiritual authority, and publicly burned the pope's bull excommunicating him. How the dispute terminated in the death of Boniface will be seen in our article BONIFACE VIII. Boniface was succeeded by Benedict XI., who died soon after; and Clement V., who succeeded him, was elected by the influence of Philip, and fixed his residence at Avignon. Clement before his election entered into a regular treaty as to the terms on which he should receive the pontificate. The destruction of the order of the Templars (1307–12), and the seizure by the king of their goods and estates, was one of the fruits of this alliance. (See TEMPLARS.) The policy of Philip was to some extent dictated by the condition of the kingdom, which it tended to consolidate. The abolition of the right of private coinage claimed by the barons, for example, was a good measure in itself; but as his own coinage was habitually falsified and frequently changed, and as his extortions increased with the duration of his reign, the most formidable discontents were ready to break out into open revolt at its close, which was further darkened by domestic tragedies in his own family, and by the burning of numerous persons accused of heresy. Philip left numerous ordinances for the administration of the kingdom, which mark the decline of feudalism and the growth of the royal power. He also convoked and consulted the states-general for the first time. He died 29th November, 1314.

PHILIP VI., OF VALOIS, King of France, head of the second branch of the Capetian line, was the nephew of Philip the Bel, to whose last son, Charles IV., he succeeded in virtue of the Salique law. He was born in 1293, and succeeded to the crown in 1328. Edward III. of England claimed the crown, but did him homage under protest for Guienne. Philip's father, Charles of Valois, had headed the feudal reaction attempted by the nobles since the death of Philip le Bel, and Philip on his accession restored some of their privileges. In 1328 he defeated the Flemings in a great battle at Cassel. Edward III. and Philip, through mutual jealousy, supported each other's enemies, but Edward, having freed himself of embarrassment on the side of Scotland, and made allies of Robert, Count of Artois, and of the Flemings, who under Arteveldt had revolted against their count, resolved to invade France and assert his claim to the crown. The first campaign was fought in Flanders 1338–40. In the latter year Edward returned to France, defeating the French fleet at Sluys, but shortly after concluded a treaty with Philip, and returned to England. From 1341 to 1343 the war was waged in Brittany, the succession to the dukedom of that province being in dispute, and Edward and Philip supporting different candidates. The candidate supported by Edward, and who engaged to recognize his claim to the crown, claimed through the Salique law; the candidate supported by Philip, who was his nephew, claimed against it. Edward invaded France again in 1346, and advanced to the gates of Paris, when the approach of Philip with a superior army compelled him to retreat. He fell back on the Somme, and gave battle at Crécy, where he gained his famous victory on 26th August. He then besieged Calais, which he took in August, 1347, after a siege of eleven months. A truce for ten years was concluded with Philip on 28th September. Next year France was visited by the pestilence called the black death. Philip died on 12th August, 1350. His reign was unfortunate for France by the long war which it inaugurated, known in France as the Hundred Years' war; and he has left an evil memory by his persecutions of Jews and heretics, his confiscations and exactions. He originated the gabelle, and like Philip le Bel he frequently changed the value of money.

PHILIP II., OF SPAIN. The position and character of this monarch, the time in which he lived, and the long duration of his reign, combine to make him one of the most important personages in modern European history. He was the son of Charles V. and Isabella of Portugal, and was born at Valladolid on 21st May, 1527. His education was intrusted to Juan Martinez Siliceo, then a professor in the College of Salamanca (afterwards Bishop of Toledo), and Don Juan de Zuñiga, commendador mayor of Castille. He acquired considerable knowledge of Latin and French, showed some capacity for mathematics, and a considerable taste for architecture, sculpture, and painting. Although Charles accuses Siliceo of carelessness, these preceptors do not appear to be responsible for the disposition Philip afterwards manifested. Even in early years he was grave and taciturn, and remarkable for self-possession and for the maturity of his utterances. Probably the admonitions as well as the example of his father had much influence in forming his character. Amid much good advice Charles inculcated on his son the maxims of absolute sovereignty which he had himself practised. It was the will of the emperor that Philip should be early accustomed to exercise his mind about state affairs. When a mere youth (1541) he intrusted the regency of Spain to Philip, along with a council headed by the Duke of Alva. In a letter of private instructions which he wrote to Philip on this occasion, the emperor says, 'The Duke of Alva is the ablest statesman and the best soldier I have in my dominions. Consult him above all in military affairs, but do not depend on him entirely on these or any other matters. Depend on no one but yourself.' In this letter he found occasion to warn his son of the dangers of libertinism. On 13th November, 1543, Philip married the Infanta Maria of Portugal, who died in July, 1545, after giving birth to a son, the unfortunate Don Carlos. (See CARLOS.) Charles desired to have Philip recognized as his successor in the Netherlands, and to secure for him the succession to the empire after his brother Ferdinand. For this purpose he ordered Philip to join him in the Netherlands, passing in his route through Germany. On this journey Philip tried to make himself agreeable to the German princes, but he did not succeed. He had already formed ideas of his own importance which were only suited for the society of his Spanish grandees. His manners also alienated the Netherlanders; while the Spaniards, who looked on him as their natural ruler, considered themselves injured by his withdrawal from the kingdom. Having negotiated for his son a marriage with Mary, queen of England, Charles gave him the sovereignty of Naples and Milan. Philip landed in England on 19th July, 1554, was married at Winchester on the 25th, and remained in England till September, 1555. He was recalled to receive the sovereignty of the Netherlands, which his father had resolved to abdicate. This was done in public assembly at Brussels on 25th October, 1555; and on 16th January, 1556, in the same hall he received, in presence of the Spanish grandees then in the Netherlands, the crown of Spain, with its possessions in Asia, Africa, and America. One of Charles's last acts was to negotiate a peace, one of the least favourable he ever made, with France. The

termination of hostilities was violently opposed by the pope (Paul IV.), and Henry II. was soon induced to recommence hostilities. In the meantime Philip had reluctantly, and after consulting his theologians, declared war with the pope. Alva was despatched into the Papal territories, whither he was soon after followed by Guise. Philip himself appeared in England, and induced Mary to declare war with France. The battle of St. Quentin (see EMMANUEL, Philibert 10th August, 1557), resulted in the rout of the only army available for the defence of the French capital, but Philip did not know how to profit by it. It enabled him, however, to make peace with the pope. Guise was immediately recalled; and Alva, left master of the situation, dictated peace (Sept. 14), and on his knees asked pardon in the name of his master for the sacrilege of which he had been guilty. The capture of Calais by Guise (7th January, 1558) avenged the battle of St. Quentin. The death of Mary followed soon after (17th November); and the Treaty of Cateau-Cambrésis (3d April, 1559) put an end to the war with France. His conduct in England has occasioned some controversy. He evidently tried to make himself popular; but the influence he possessed over Mary is quite sufficient to make it evident that he approved of all the barbarities of her reign, as nothing would have been easier for him than to have put a stop to them. One of the main inducements to the Peace of Cateau-Cambrésis was to enable both monarchs to turn their attention to the suppression of heresy. The marriage of Philip with Elizabeth of France, called by the Spaniards Isabel de la Paz (22d June, 1559), was designed to cement the alliance between the two pious monarchs. The principal French allies of Philip in fanaticism were the Guises; but a political danger at this time overcame even this strong bond of union, and Philip, who feared to see the crowns of England and Scotland united with that of France, protected Elizabeth, to whom he had offered his hand in vain, against a descent on England in favour of Mary Stuart. In 1559 he finally left the Netherlands, his main object in returning to Spain being to check the progress which the Reformation had made there. On his arrival in his native country, on his voyage to which he narrowly escaped shipwreck, he had the pleasure of being present at an auto-de-fé; and a few years' perseverance in similar measures extinguished the light of the Reformation, together with the spirit of freedom and enterprise in Spain. The cause of religion in France was also a constant subject of solicitude with Philip, but his zeal for it was occasionally disturbed by political complications. In 1562, however, he zealously exerted himself to excite opposition in that country to the edict of toleration passed at the beginning of that year. In Naples, as in Spain, his zeal led him to persecute the Protestants; but it was in the Netherlands that his bigotry and obstinacy had their most disastrous, though ultimately fortunate results. The details of the measures adopted by his agents will be found in the history of that country. To illustrate the spirit in which he acted, a single fact will suffice. In July, 1566, soon after receiving with flattery Count Egmont, who had been despatched to lay before him the grievances of the Netherlanders, alarmed at the gathering storm excited by his habitual violation of the laws and constitution of the country, he sent to his sister Margaret, the regent, a despatch consenting to the abolition of the Inquisition on condition that the bishops should be invested with inquisitorial power, and some other concessions of a like nature. At the same time he protested before a notary that these concessions had been extorted by force. A wilder extravagance was committed by him in 1568, when he publicly confirmed (5th February) a decree of the year after (5th February) sentencing all the inhabitants of the Netherlands to death. The excellent Emperor Maximilian sent him this year (3d March) a holograph letter protesting against his cruelties to the Netherlanders, who were entitled to the protection of the empire. Philip replied that his love of justice had made him so slow in suppressing revolt, and that his measures would finally be approved of by every one. His enmity to England was excited both by religious zeal and by the support given by Elizabeth and the English people to his revolted subjects in the Netherlands. Among the measures which he deemed it commendable to pursue for the gratification of this and other passions, as well as in pursuit of religious and political objects, was assassination. In 1571 he entered into the plot of an Italian, Ridolfi, to assassinate Elizabeth. In this he was so far culpable that Ridolfi was recommended to him for this purpose by Pope Pius V.; but the matter was not skilfully handled, for Alva, to whom Philip intrusted it, sent two assassins into England after the discovery of the plot. Philip was at this time openly courting the alliance of Elizabeth. On Oct. 7, 1571, his half-brother the Archduke John won the battle of Lepanto for the Holy League against the Turks, into which Philip had entered with the pope, and the Republic of Venice. The first project of the league was negotiated in this year between Philip and the Duke of Guise. He received the news of the St. Bartholomew massacre with sincere and malignant joy, viewing it at once as an error in the policy of his rivals and a wholesale destruction of his enemies. In 1573 Philip's religious zeal underwent a temporary abatement. He saw a prospect of succeeding to the German Empire on the death of Maximilian, and he engaged if he should do so to recognize the privileges of the Netherlanders, and reinstate the Prince of Orange and his 'accomplices' in their possessions. In 1579, on the advice of Granvella, he proscribed William, putting a price of 25,000 gold crowns on his head. In April, 1581, Philip succeeded to the crown of Portugal, with its splendid eastern possessions, and he spent the two following years in that country. About this time he found political motives for intriguing with the Huguenots in France, and twice in 1582 made offers of assistance to the King of Navarre. In 1584 he renewed his alliance with the league, in order to oppose the succession of Henry to the crown of France. In 1586 Philip declared war with England. The year 1588 saw the destruction of the Armada and the descent of Spain from her position as a first-class power in Europe. In 1589 Philip missed, by his overweening self-conceit, an opportunity of making himself master of France. The States-general assembled by Mayenne proposed to recognize the Infanta Isabella Clara Eugenia as heiress of the French crown; but Philip refused to marry her to a French prince, and when he conceded this point declined to name her husband. Philip carried on his opposition by intrigues and warfare against Henry IV. for some years, but in 1598 the Peace of Vervins was concluded with France. He showed some disposition at the same time to make peace with England and the Netherlands, but his offers were not accepted, and he died without recognizing the independence of the latter country or being reconciled to the former. During his last years he suffered from diseases brought on by debauchery, which took a revolting form, his body being covered with vermin, which the skill of his physicians was unable to destroy. He died at the Escurial, 13th September, 1598. Before his death he had bestowed the sovereignty of the Spanish Netherlands on his daughter Isabella, subject to the

crown of Spain; and he was succeeded in Spain by Philip III., his son by Anne of Austria, his fourth wife.

Philip's character had some points in resemblance with that of James II. of Britain. He succeeded in disintegrating a great empire by means very similar to those which lost James his crown. He sometimes bent his views to policy, but his schemes of intolerance were never forgotten or left long in the background. His influence on Spain was very disastrous. The spirit of the people was crushed by intolerance and tyranny, and it may be said that even to this day Spain is suffering from the oppression of Philip II. The Netherlands were more fortunate, and Europe owes him the foundation of the Dutch Republic. His licentious amours occasioned one disgraceful murder, besides the assassinations he was continually plotting. He gave Antonio Perez written instructions to assassinate Escovado, the secretary of the Archduke John, and when he had accomplished the deed compelled him by threats of prosecution to give up the document. He left to his children the whip with which he and his father had scourged themselves, with as little benefit in his case, it would appear, to his moral conduct as the scourge he applied to his subjects had on their material prosperity.

PHILIP V., King of Spain, was the first Spanish king of the Bourbon dynasty. He was the grandson of Louis XIV. of France and second son of the Dauphin. He had by birth the title of Duke of Anjou. Philip was born at Versailles in 1683. He succeeded to the crown of Spain by the will of Charles II., who died without direct heirs, as the grandson of Charles's elder sister. On the death of Charles in November, 1700, he was immediately proclaimed king, and was generally recognized in Spain, Naples, and the Netherlands, but the succession had long been a matter of European alliances, and soon became the occasion of a European war, in which Philip was sustained only by France and the minor powers dependent on her, while one of his competitors for the crown, the Archduke Charles, second son of the emperor, and who afterwards succeeded to the empire, was supported by the whole weight of one of those great coalitions formed to check the ambition of Louis XIV., the second Grand Alliance, in which England, Holland, the Empire, most of the German states, and afterwards Portugal, took part. He married in 1701 Maria Louisa Gabriella, second daughter of the Duke of Savoy. Notwithstanding the splendid successes of Eugene and Marlborough, the great commanders of the alliance, the revolt of Aragon, and the temporary successes of Peterborough and Galway in Spain, the kingdom was secured for Philip chiefly by the victory of Almanza won by the Duke of Berwick 25th April, 1707, and he was confirmed in possession of it on renouncing his claim to the crown of France by the treaties of Utrecht in 1713 and of Rastadt in 1714. It was during this war, however, that Gibraltar was lost to Spain, Minorca was also ceded to England, Sicily to Savoy, the Netherlands, Naples, and the Milanese to Austria. Philip's wife died in February, 1714, and the Princess des Ursins, whom she had brought with her from Savoy, and who enjoyed the position of first favourite, persuaded Philip to marry Elizabeth Farnese, niece of the reigning Duke of Parma. In this the princess had miscalculated. The marriage took place in September, and she was immediately deposed from her position by the influence of the new queen. The confidence of Philip was now given to Cardinal Alberoni, the minister of the Duke of Parma in Spain. Philip was pious and uxorious, and the estimate formed of his character by his new minister was that a wife and a hassock were all that the King of Spain needed. Alberoni accordingly prepared to govern Spain. Peace was for a time essential to his views, but it was only as a means of accomplishing ambitious projects. As Philip had a son by the first wife the children of Elizabeth could not succeed to the crown of Spain. Elizabeth wished to provide for them in Italy, and even coveted the reversion of the crown of France. These pretensions formed the basis of Alberoni's schemes, who proposed to raise Spain to the predominance in Europe which she had lost since the time of the Emperor Charles V. (See ALBERONI.) These schemes of Alberoni alienated France and led to the Triple Alliance formed in 1717 by Great Britain, France, and Holland against Spain, and which, after some temporary successes of the Spaniards (conquest of Sardinia, August, 1717), was merged by the accession of Austria into the Quadruple Alliance (August, 1718). The invasion of Spain by the Duke of Berwick compelled Philip to accede to the terms of the alliance. Spain ceded her conquests, but secured the reversion of Parma and Tuscany to the children of the queen, and Alberoni was dismissed. This was followed by intermarriages between the royal families of France and Spain. The Prince of Asturias, heir of Spain, and Don Carlos, heir of Tuscany and Parma, were affianced to two daughters of the Regent Orleans, and the Infanta to Louis XV. Philip, who was a prey to religious melancholy, and through the Jesuits, by whom he was governed, as great a persecutor as Philip II., now took a step attributed by some to hypochondria, by others to policy. He resigned the crown of Spain in favour of his son Don Louis (January, 1724), with a view, according to the latter explanation, to secure the reversion of the crown of France in the event of the death of Louis XV., whose health was then in a declining state. But the Prince of Asturias died in the following August, and Philip resumed his crown. In the following year the Infanta was sent back to Spain on the pretext of her being too young for Louis, an affront which nearly provoked a war with France and induced a closer alliance between Philip and the emperor. Philip guaranteed the Pragmatic Sanction and entered into various stipulations offensive to England as well as to France, as the restoration of the Stuarts by force of arms. The queen, however, finding that the alliance of Austria did not forward her views in Italy, brought about a reconciliation with England by the Treaty of Seville, 9th November, 1729, which guaranteed the succession of the Italian duchies to Don Carlos. A similar engagement was entered into by the emperor by the second Treaty of Vienna, March, 1731, but the war of the Polish Succession followed, and Italy was invaded by a Franco-Spanish army under Don Carlos. In this war Spain was deserted by France, by whom it was begun. Peace was concluded in 1736, and after protracted negotiations the third Treaty of Vienna was signed, 18th November, 1738, in which Naples and Sicily were assigned to Don Carlos in place of Tuscany, which was ceded to the son-in-law of the emperor. Mutual commercial grievances next led to a war with England, which was declared in November, 1739. This was followed by the death of Charles VI. (1740) and the war of the Austrian Succession, in which Philip took part with France and the enemies of Austria against England and her allies. He died before this war was concluded, 9th July, 1746, after a reign of forty-six years. Philip was constantly governed by favourites, and his constitutional melancholy at last completely incapacitated him for business. For the last ten years of his reign his chief favourite was an Italian singer, Farinelli (see FARINELLI), who had

charmed him with his voice. Notwithstanding this weakness and his religious bigotry, his love of justice and patriotic regard for the interests of his adopted country was the source of his subjects, and he died regretted. He patronized art and literature, and encouraged commerce. He or his ministers also improved the condition of the army and navy. He was succeeded by Ferdinand VI., his second son by Maria Louisa of Savoy.

PHILIP THE BOLD, Duke of Burgundy, born in 1342, was the fourth son of John, king of France. He fought at Poitiers (1356), where, according to Froissart, he acquired the surname of the Bold. He shared his father's captivity in England, and on his return his father, whose favourite he was, made him Duke of Touraine, and after the death of Philippe de Rouvre (1361) he secured for him the Duchy of Burgundy, which he had united irrevocably to the crown, and made him premier peer of France. The consolidation of this powerful fief, the source of many future calamities to France, was confirmed by Charles V. on his accession to the crown, when Philip resigned the Duchy of Touraine. Philip married in 1369 Marguerite, daughter of Louis, count of Flanders, which gave him on the death of his father-in-law (1384) the counties of Flanders, Artois, Rethel, and Nevers, and made him one of the most powerful sovereigns of Europe. During the reign of Charles V. Philip served against the English with ability and success in several campaigns in Beauce and Burgundy (1364), before Calais (1370), in Poitou (1372), and Flanders (1377). On the death of Charles (1380) he shared the administration of the kingdom with his brothers the Dukes of Anjou and Berry, and when the former, who claimed the regency by right of birth, left for Naples in 1382, the chief burden fell on him. The administration was not creditable to the brothers. Each of them concerned himself with his own hereditary dominions, and the revenues of the kingdom were wasted on their schemes of private aggrandizement. Notions of liberty were at this time beginning to be widely diffused in the cities, and the insurrectionary movements, excited by excessive taxation and other acts of oppression, were put down with a ruthless hand. In 1382 Philip assisted his father-in-law against his revolted Flemish subjects, who sustained a crushing defeat at Roosbeque (27th November). In 1385 immense preparations were made and vast sums uselessly expended in preparing for an invasion of England which never took place. The number of vessels collected, according to Froissart, would have sufficed to form a bridge from Calais to Dover. An expedition against the Duke of Gueldres, an ally of England, in 1388, was similarly costly and unproductive. The alliance of the Flemish democrats with England gave Philip a double motive for his hostility to that country. His administration in Flanders appears to have been wise and conciliatory. In 1388 the king took upon himself the administration of the kingdom. In 1392 he showed signs of insanity, and his uncles resumed the regency. The ministers of the king, who had been chosen from among the commonalty, the *Marmousets*, as they were called by the party of the great nobles, were banished. There were assassinations and deeds of violence between the parties, but nothing of this kind seems to be charged to Philip. He retained the regency till his death in 1404, though opposed by his nephew the Duke of Orleans, who was afterwards assassinated by his son Jean Sans Peur.

PHILIP THE GOOD, Duke of Burgundy, son of Jean Sans Peur, was born at Dijon in 1396. His father was assassinated in 1419 by the partisans of the Dauphin, afterwards Charles VII., and Philip, who had been brought up at a distance from the scenes of contention in France, was called to succeed him. He immediately entered into the Treaty of Arras, by which he recognized Henry V. as successor to the crown of France. Charles VI. himself, guided by his queen Isabeau, concluded with him the Treaty of Troyes (1420), which was accepted by the states-general and the parliament, excluding the Dauphin from the succession and recognizing Henry as administrator of the kingdom and heir to the crown. Henry V. and Charles VI. died in 1422 and Henry VI. was proclaimed King of France. Bedford, who now became regent of France, married Philip's sister. The English, however, soon began to carry things with too high a hand, and finally alienated the Duke of Burgundy. Gloucester, regent of England, married the Countess of Hainault, and provoked a private war with Philip by taking forcible possession of her heritage. After bringing about a conference at Arras (1435), at which he failed to reconcile the two parties, Burgundy made his peace with Charles, who repudiated the murder of his father, recognized his independence, ceded to him some territories, and made a defensive alliance with him. Philip afterwards declared war on England, but soon made peace for his own states, and endeavoured, though in vain, to negotiate a peace for France. He ransomed the Duke of Orleans, who had been a prisoner for twenty-five years in England, and gave him his niece in marriage. He received the Dauphin Louis (see LOUIS XI.) at his court, when he quarrelled with his father (1456), but refused to assist him further than by his mediation. He gave him, however, a pension of 600 louis and a residence in the Castle of Genappe. Charles remarked that he had received a fox who would devour his poultry. Philip accompanied Louis to his coronation (1461), where he displayed a magnificence which was in accordance with his tastes. Louis took advantage of his extravagance to purchase from him in 1463 the towns of the Somme ceded by his father as the price of the alliance of the Duke of Burgundy. Philip's son, Charles, count of Charolais, who had also quarrelled with his father and been reconciled, was offended at this concession, which Louis had used all his arts to draw from his father, and entered with other disaffected nobles into the League of Public Good (1465). Philip had by this time fallen into a state of mental incapacity, and the affairs of his dominions were managed till his death in 1467 by his son, who then succeeded him. Philip was dissolute in his manners as well as profuse and ostentatious in his tastes. He left numerous natural children.

PHILIPP I. (THE MAGNANIMOUS), Landgrave of Hesse, was born in 1504 near a town of the Palatinate called Caub, which the Hessians under William his father were then besieging. After the death of his father in 1509 he lived under the guardianship of his mother, and in 1518, on attaining his fourteenth year, assumed the reins of government. He vanquished Franz von Sickingen in 1523, and joined the princes who went out in 1525 to quell the insurrection of the peasants. This was effected by the battle of Frankenhausen; and the landgrave, befriended by John, elector of Saxony, was gained to the cause of the Reformation. The same year he issued his edict on the preaching of the gospel and the morality of the clergy, and to aid the success of the new doctrine, and secure its followers from hostile attacks, his spirited counsels led to the League of Torgau, formed between him and the Elector of Saxony in 1526. After this he attended the Diet of Spires, and spoke out strongly and firmly for the rights of the Lutheran Church. After his return he began the Reformation on an extensive scale. The monks were expelled from the monasteries, and their revenues were confiscated

and devoted to secular and useful purposes. In 1527 he founded the University of Marburg. He was driven into warlike measures by his zeal, inflamed by the information of Otto von Pack that the Catholic princes had concluded a league for the suppression of the Reformation. In these circumstances he subscribed the protestation to the Diet of Spires in 1529, submitted the Confession of Faith at Augsburg in 1530, and neither the personal representations of the emperor nor the political advantages offered to him could make him unfaithful to a cause whose blessings to humanity lay unfolded in all their magnitude before his mental vision. In the highest indignation he quitted the diet with his numerous warlike followers, and after forming an alliance for six years with the cantons of Zürich, Basel, and Strasburg with reference to attacks on religion, attended the conference of the Elector of Saxony, the Marquises of Anhalt and Brandenburg, and the Count of Mansfeld at Schmalkalden, and was, with the Elector of Saxony, in 1531, head of the Schmalkald League. In 1542 he fought victoriously against Duke Henry the younger of Brunswick, but was obliged to submit to the Emperor Charles V. after the battle of Mühlberg (1547). On this occasion he confided in the favourable mediation of his son-in-law Maurice, duke of Saxony, but, contrary to the true meaning of the capitulation, was detained a prisoner by the emperor, was obliged to give up his artillery, and pay a fine of 150,000 florins. In 1552, by means of the Passau Treaty, he obtained his freedom. After his return to his dominions he sent a body of auxiliaries to assist the French Huguenots. He afterwards laboured diligently to govern on popular principles, divided his possessions among his four sons, and died in 1567. With the consent of his wife, Christina, who lived till 1549, and after he had obtained the consent of Luther and Melanchthon, he in 1540 married Margaret of Saale, usually called the *left landgravine*, and had by her six sons and a daughter. He was equally magnanimous and courageous, well-informed and active, but displayed little statesmanship in his measures. See Rommel, Philipp der Grossmüthige Landgraf von Hessen, nebst einem Urkundenbuche (three vols. Giessen, 1830).

PHILIPPEVILLE, a city of Algeria, in the province and 39½ miles N.N.E. of Constantine, near the ruins of the ancient Rusicada, at the head of the Bay of Stora. It is well laid out, has several spacious squares, and fine streets, a large military hospital, with a handsome chapel; a parish church, and a chamber of commerce, and a brisk trade. Pop. (1881), 15,580.

PHILIPPI, a city of Macedonia, in Thracia, founded by Philip of Macedon, who captured the site from the Thasians, and colonized it about B.C. 356. The previous settlement was called Crenides, from the numerous springs which rise in the locality. Its chief advantage lay in its command of a district rich in gold mines, which Philip caused to be worked to great advantage. The two battles fought in B.C. 42, which resulted in the overthrow of Brutus and Cassius by Antony and Octavius, were fought here. Philippi was visited on several occasions by the apostle Paul, who addressed to it one of his epistles. (See PHILIPPIANS.) The ruins of Philippi still exist.

PHILIPPIANS, epistle of Paul the apostle to, is supposed to have been written from Rome towards the close of St. Paul's first imprisonment there, about A.D. 63. Some authorities suppose it to have been written in Cæsarea. (See PHILEMON.) The genuineness of this epistle has only been questioned by Baur and the Tübingen school. It is referred to, though not quoted, in the epistle of Polycarp and by Tertullian and other early fathers. The epistle appears to have been written primarily to acknowledge the zeal of the Philippians in sending to minister unto him in his imprisonment. Epaphroditus, who conveyed it, was the messenger of the Philippians to Paul, and had been ill at Rome, which had been a cause of anxiety to the Philippians. Paul, therefore, hastened his return, and sent this epistle by him. It gives an account of the apostle's views and feelings on the subject of his imprisonment, and in contemplation of his approaching trial. It is full of exulting faith, and contains many exhortations based on the example of Christ and the doctrines of Christianity, but none of those systematic and argumentative statements of doctrine which are to be found in the other epistles of Paul.

PHILIPPICS, the three orations of Demosthenes against Philip, king of Macedon. (See DEMOSTHENES.) This name was also applied to Cicero's fourteen speeches against Antony, and it has hence come to signify an invective in general.

PHILIPPINES, or PHILIPPINE ISLANDS, an archipelago in the Pacific Ocean, lying north-east of Borneo, having on the west the China Sea, on the east the North Pacific, and on the south the Sea of Celebes; lat. 5° 32′ to 19° 38′ N.; lon. 117° 21′ to 126° 8′ E. It consists of forty islands of considerable size, and a large number of smaller ones. Of the former the chief are Luzon, Mindoro, Samar, Panay, Leyte, Zebu, Negros, Bohol, Mindanao, and Palawan. The shore lines and internal surface of the larger islands are extremely rugged and irregular. Their magnificent mountain ranges are clothed with a gigantic and ever-teeming vegetation; and between these lie extensive slopes and plains of the richest tropical fertility, watered by numerous lakes and rivers, which afford abundant means of irrigation and transport. On the western parts it rains from June to September, but in October a change of wind transfers the rains to the eastern parts. These rains are so intense as to make vast lakes of the low grounds, and to render the highways impassable. The heats are tempered by perpetual moisture, and by the alternations of the land and sea breeze. The climate on the whole is healthy. Earthquakes are frequent, and often very destructive.

Metalliferous mountains everywhere occur. Gold is procured in the sand of the rivers. Ironstone is found yielding eighty per cent. of iron; and rich specimens of copper attest its presence. Among the numerous volcanoes, extinct or active, abundance of sulphur is found. Coal exists in some spots, but is not worked to any extent. There are vast deposits of limestone and marble, and Negros produces magnesia and alum.

The mountains are covered with gigantic timber. Among plants cultivated for use are the abaca or Manilla hemp, the pine-apple, the gommuti-palm for their filaments; the cocoa, and other palms; the cotton, coffee, and cacao-tree; the sugar-cane, indigo, tobacco, and the tamarind. Cassia, cloves, the wild nutmeg, and the red and black pepper vines, are found in Mindanao. Rice is raised in large quantities, both for home consumption and export. To these add maize, wheat, yams, the sweet-potato, and a great variety of delicious fruits, oranges, lemons, &c.

The buffalo is employed in tillage, and as a beast of burden. Both it and the ox are found in a wild as well as domesticated state. The Philippines produce small but spirited horses, deer, hogs, goats, and sheep; diminutive foxes and gazelles; several varieties of monkeys; wild cats, &c. The woods are full of game-cocks, pigeons, eagles, pelicans, herons, wild ducks, quails, and the smallest-sized falcon known. The jungles swarm with humming-birds, parrots, and the horn-bill. On the shores are found the sea-

swallows, whose nests are so prized by the Chinese as food. The lakes and rivers teem with crocodiles and fish. Fish also, including crustaceans, are found in great variety in the seas; and there is no lack of serpents, leeches, insects, and reptiles.

The natives are of diverse origin. Wild tribes, some of which are extremely ferocious, still haunt the mountains. The chief mountain tribes are the Negritos, diminutive negroes, who have given their name to the island Negros, though not confined to it; and the Ætas or Itas, a dusky or copper-coloured race, which, like the Dyaks of Borneo, slay men for the sake of procuring their heads. But the great mass of the subjects of Spain are divided into the Tagals, inhabiting Luzon, and the Bisayans, who inhabit the other islands. These speak respectively the Tagal and Bisayan tongues, each of which has a variety of dialects. The Tagals are more addicted to agriculture than the Bisayans, who, like the Malays, are attached to a sea-life and fishing. Both Tagals and Bisayans unite the indolence and the artistic ingenuity of the Hindus, with the vindictiveness of the Malays and their passion for cock-fighting. The Chinese play an important part in the Philippines. Restricted to tillage by the law, their activity and address make them indispensable as mechanics, shopkeepers, and traders. They have civil regulations, and a police of their own; conform to the Romish Church, celebrate with great magnificence the festival of their patron saint, St. Nicolas; and being envied and hated by the Indians, aid the government in maintaining that balance of opposing interests to which mainly it looks for the support of its own institutions. Half-castes, Indo-European and Indo-Chinese, engross much of the business and wealth of the islands. The independent tribes are partly Mohammedan and partly heathen. The subjects of Spain are professedly Roman Catholics, and under a hierarchy with the Archbishop of Manila at its head.

The textile productions of the Philippines are considerable in number; ranging from the delicate and costly *pina* muslins, made from the pine-apple fibre, and *sinamays* made from it, mixed with the abaca filament, to coarse cottons, sacking, and the beautiful mats made of the abaca and gommuti-palm fibres. Hats and cordage are manufactured to a considerable extent, and, as a government monopoly, cigars. European art is successfully imitated by the natives in ship-building and coach-building, in the dressing and varnishing of leather, and in the manufacture of cordage. An extensive trade, which has increased rapidly since the dissolution of the Company of the Philippines in 1834, is carried on in exporting sugar, tobacco, Manila hemp, indigo, coffee, birds'-nests, trepang, sapan-wood, dye-woods, hides, ratans, mother-of-pearl, gold dust, &c., and in importing manufactured cotton goods, marine stores, wines and liquors, porcelain, cutlery, metals, drugs, &c. The total exports for 1882 were estimated at £2,800,000, a great proportion of which went to Britain. The imports were given at £5,400,000, to which amount Britain and her colonies contributed about four-fifths.

Luzon is distinguished as a grand division from all the other islands, these being called Bisaya. All, however, are, together with the Marianne Islands, under the same central government at Manila. The whole Spanish dependencies are divided into thirty-three provinces, but some parts of these are only nominally subject to Spain. The provinces are divided into *pueblos* or townships.

The supreme civil and military government is in the hands of a governor-general, appointed by the crown. Besides being commander-in-chief of the land and sea forces, he is president of the supreme court of justice, vice-patron (that is, viceroy), and sub-delegate judge of couriers, posts, and expresses. In the discharge of these functions he is assisted by ministers and *juntas*, with whom to advise, or to whom he may delegate his powers. An alcalde-mayor, or corregidor, is appointed directly by the crown for each of the provinces, as administrative, judicial, and fiscal officer. Each pueblo is under a native *gobernadorcillo* or mayor, popularly elected, and these again are assisted by inferior officers, chosen also from lists presented by the inhabitants. The Chinese and Chinese half-castes are allowed magistrates of their own. Both army and marine consist almost entirely of natives.

History.—The Philippines were discovered by Magellan in 1520–21, and after repeated expeditions, several of which proved disastrous, were finally annexed to the Spanish dominions, and named after Philip II. They were designed as a field rather of missionary than of commercial enterprise, to atone, if possible, for the unheard-of cruelties practised by the Spaniards in America. Hence the religious orders have from the first had great influence in the establishment and institutions of the colony, and to them the land largely belongs. In 1762 Manila was taken and for a short time held by a British fleet. Since the loss of her continental American possessions, the Philippines are now of great importance to Spain, and their productions and trade are in a state of rapid development. The total population, according to an estimate contained in a consular blue-book published in 1880, is over 6,000,000.

PHILIPPONES, a Russian sect, a branch of the Roskolnicians, so called from their founder, Philip Pustoswiæt. The sect took its rise in the northern part of Russia, towards the end of the seventeenth century, and neither acknowledges the pope, nor esteems consecration by the Russian Church as valid. They differ from the other Roskolnicians chiefly in having no ordained clergy. Communion, confirmation, absolution, and marriage, by ecclesiastics, were not, therefore, practised among them. (See GREEK CHURCH and ROSKOLNICIANS.) In each of their societies is an elder (*starik*), chosen by themselves or by his predecessor, who can read Slavonic, and is obliged, after his baptism, to abstain from strong drinks. He performs the different clerical offices. Absolution, they consider, must be received immediately from God. They scruple to take an oath, or to perform military service. Many Philippones fled, in the beginning of the eighteenth century, into Polish Lithuania, whence some of them passed into the Prussian territories.

PHILIPPOPOLIS, or FILIBI, a town, European Turkey, Rumelia, on an island formed by the Maritza, 86 miles W.N.W. of Adrianople. In 1818 it was almost totally destroyed by an earthquake; but it has since recovered through its trade and manufactures in silk cloth. Pop. 30,000 to 40,000.

PHILIPPSBURG, a town of Baden, in the circle of Carlsruhe, on the right bank of the Rhine, in a marshy and unhealthy district, 16 miles north of Carlsruhe. Philippsburg was formerly a celebrated imperial fortress, and up to 1803 belonged to the bishopric of Spires. It was fortified by Philip, bishop of Spires, in 1618 and 1623, who had chosen it for his residence, and changed its name from Udenheim. In the Thirty Years' war it fell successively into the hands of the Swedes, the French, the imperial forces, and again of the French. In the wars between Louis XIV. and Germany it was taken by the Germans in 1676, was assigned to them by the Peace of Nijmegen in 1679, was taken by the French again in 1688, but restored by the Peace of Ryswick in

1697. In 1734 the French retook it with little trouble, but with the loss of the Duke of Berwick. In 1800 its fortifications were demolished after it had been bombarded and taken by the French. Pop. (1880), 2549.

PHILIPS, AMBROSE, a poet and dramatic writer, was a native of Leicestershire, born about 1671–75, and studied at Cambridge. On quitting the university he went to London, and became one of the literary wits who frequented Button's coffee-house, and a friend of Steele and Addison. The publication of his Pastorals involved him in a war with Pope, who ridiculed them in the Guardian, Martinus Scriblerus, &c., in consequence of which Philips threatened to inflict personal correction on the satirist. He was one of the writers of a periodical paper called the Freethinker; and Dr. Boulter, the conductor, obtaining preferment in Ireland, Philips was made registrar of the prerogative court at Dublin. He returned to England in 1748, and died the next year. He was the author of the Distrest Mother, a tragedy (1712), taken from Racine; the Briton (1722), and Humphrey, Duke of Gloucester (1723). He also wrote a number of short-lived poems, which procured him from Pope the nickname of Namby-Pamby.

PHILIPS, JOHN, an English poet, born in Oxfordshire, 1676, was educated at Christchurch, Oxford, where he produced the Splendid Shilling, in which the sonorous cadence of the blank verse of Milton is adapted to familiar and ludicrous topics. He also wrote Blenheim, a poem in celebration of the Duke of Marlborough's victory; and Cyder, a work in imitation of Virgil's Georgics. He died in 1708. He imitates Milton's style in all his poems.

PHILISTINES, a people of Palestine, who gave their name to the whole country. (See PALESTINE.) Hardly anything is known of the history of the Philistines except from incidental notices of them in the Bible in connection with the history of the Jews, and little light seems to have been thrown on these notices by biblical critics, who are at variance on almost every point referred to in them. The name is commonly understood to mean wanderers or emigrants, although there are other interpretations. The origin of the Philistines is much disputed. It is referred to in Genesis x. 14, where their descent is given from Mizraim, son of Ham; Deuteronomy ii. 23; Jeremiah xlvii. 4; Amos ix. 7, and other passages. We have not space even to state the philological and other hypotheses founded on these passages, and can only mention that the two leading theories (which will be found discussed in Kitto's, Smith's, and Fairbairn's Biblical Dictionaries) connect them with Crete and with Egypt, and that the latter hypothesis seems to present the least insuperable difficulties. Bertheau, Movers, Von Lengerke, and J. R. Beard (in Kitto's Dictionary) advocate the former. They are also identified with the Hycsos, who for a time held Egypt in subjection. The Philistines are first mentioned as a pastoral people living in Gerar in the time of Abraham, and with whom he made a covenant. By the time of the exodus they appear to have occupied the southern coast of Palestine, and to have become a powerful and commercial people. The first mention of them in Genesis is held, however, by many critics to be an interpolation, or to indicate only a pastoral people living in the country afterwards occupied by the Philistines. At the time of the invasion of Palestine by the Hebrews they possessed the whole of the Shephelah or low country along the coast from the river of Egypt to Ekron, and formed a confederacy of five leading cities—Gaza, Askelon, Ashdod, Gath, and Ekron, with their dependencies, under five lords. Their lands were divided among the Israelites, being appropriated to Dan and Judah—not apparently because they were reckoned among the doomed Canaanitish nations, but because they had occupied the territory of one of them, the Avims; and their country was consequently part of the possession promised to Abraham. No attempt, however, was made to occupy it during the time of Joshua. The first intimation of any encroachment on it is in Judges i. 18, where Judah is said to have taken Gaza, Askelon, and Ekron, with the coasts thereof; but this verse is held to be inconsistent with Judges iii. 3, and if not an interpolation, the occupation to which it refers must have been very temporary. During the period of the Judges the Philistines appear to have taken advantage of the declining vigour of the Hebrew commonwealth, and the inability of the Israelites to defend themselves against the numerous hostile nations by whom they were surrounded to gain a complete ascendency over them. With the exception of occasional but rare inroads from Egypt or Phœnicia, the Philistines themselves had no enemies but the Israelites to dread, and when left undisturbed by them, could prepare at leisure to take advantage of all their troubles and divisions. The neglect of the latter to complete the conquest of a territory thus sheltered by themselves, and forming an integral part of their own possessions, was thus a manifest breach of sound policy. In the time of Saul the ascendency of the Philistines had, notwithstanding occasional defeats, become established. Instead of a regular tribute the Hebrews seem to have been subjected to the far more oppressive infliction of periodical predatory excursions, to whose devastations they were able to oppose no resistance. A superiority so manifested could not fail to kindle personal resentments when public spirit was too low to resist it, and the vindictive policy pursued by Samson was at once the natural result of the situation, and the best means of exciting the patriotic emulation of his depressed countrymen. The Philistine ascendency seems to have been one of the chief motives that weighed with the Israelites in demanding a king to concentrate their force for defensive purposes, and the conquest of the Philistines was naturally one of the first objects of the Hebrew monarchy. This was accomplished partially under Saul and more completely under David, who carried the war into their own territories, so that in the reign of Solomon the Philistines were completely subdued and put under tribute, but they appear otherwise to have been left undisturbed under their own laws and organization. They consequently reappear as an independent state after the division of the Kingdom of Israel. Their power had evidently by this time been so far broken that they did not dare to attack the Kingdom of Judah, which from its immediate neighbourhood could have speedily brought the whole of its organized military force to bear against them; but they seem to have resumed their predatory habits at the expense of the Israelites, who were in a less favourable position for retaliating by a regular invasion. This may be gathered from the incidental notices of the sieges of Gibbethon in the reigns of Nadab and Elah (1 Kings xv. 27; xvi. 15). In the first instance it is said that all Israel were encamped against Gibbethon, and in the second that the people were encamped against it. In the midst of dynastic troubles the securing of this border stronghold seems to have been a national object, which is most easily explained by supposing that it was desired as a protection against predatory incursions. When the Jewish monarchy began to decline the Philistines waxed bolder. They invaded Jerusalem under Jehoram, and under Ahaz recovered some of their ancient possessions (2 Chron. xxviii. 18). They as well as the Jews suffered from the conten-

[illegible] of the Egyptian and Assyrian monarchs, and their nationality became merged in the succession of empires which successively [illegible] the East from the time of Sennacherib. When the Jews recovered their independence under the Maccabees they conquered the country of their ancient enemy, and it was subsequently annexed by Pompey to the province of Syria.

Of the language of the Philistines nothing is known. It was not Canaanitish, as is inferred from the names of their chiefs, but there is no proof that these names were borrowed in Canaan. From one passage (Ezek. xxv. 16) it appears that it differed from the language of the Jews. They worshipped Dagon, Astaroth, Zeus-Ammon, and Derceto, a fabulous half-woman and half-fish. They had temples to these deities in their principal cities, and were superstitiously credulous in their devotion to them. The Philistines appear to have had a maritime trade and a share in the inland traffic carried on by caravans between Egypt and the countries to the north of them. Their country was remarkably productive, but their agricultural industry would probably be somewhat impaired both by their opportunities for commerce and the facility of raising the harvests of the Hebrews.

PHILLIP, John, R.A., painter, was born in Aberdeen 19th April, 1817. He was the son of a working musician, who had previously served in the army. He was educated till the age of eleven at the Lancasterian school, after which he was compelled to contribute to his maintenance by acting as errand-boy to a tailoress. He here acquired the rudiments of his art by making pictures from his own imagination with the paint used by his master for painting pale and watering-cans. When he had attained the age of thirteen he received some instructions from a local portrait-painter, and began to acquire a certain celebrity by painting emblems for badges to be used in trade processions. He also attempted a portrait of his grandmother. He next became an indentured apprentice to a house-painter and plumber. Here he devoted to his master's work the most diligent of apprentices, applying himself zealously to the mixing of putty when his employer was present, and withdrawing from its hiding-place some unfinished sketch, and working at it as zealously whenever his master's avocations took him elsewhere. During his apprenticeship he began to paint portraits for which he charged a guinea a pair (husband and wife). He afterwards at his own request was taken into the employment of a portrait-painter, James Forbes, where for the first time he had proper materials and regular instruction. His colouring already excited the admiration of his master. In 1834 he made a visit to London in a coasting-vessel to visit the Royal Academy's exhibition. On a subsequent visit he saw the paintings of Sir David Wilkie, which aroused his emulation to paint a Scottish interior—it was that of his father's house, a cobbler's kitchen. Another picture, the Packman's Visit, had an important influence on his future career. It was seen and admired by Mr. Pryse Gordon, a connoisseur and writer on painting, who discerned in it the promise of future eminence (for a different version of this story see the Athenæum, 1867, vol. i. pages 323 and 367), took Phillip to his own house, and procured a tutor for him. Prosperity, however, had its drawbacks, and Phillip soon found he could have too much even of painting. His patron thought application was everything, and would have kept him at work from morning to night. Phillip, who found his genius crushed by this drudgery, rebelled. 'Does he think,' he said, 'that I can paint at no more expense of mind than it took to put the red and green on the pails and nurses watering-cans?' Phillip now attempted to escape from too much painting by going to sea. But he was soon back, and his parents were not to be baulked of his good intentions. He proposed raising a subscription among his friends for the young artist's education; but on applying to Lord Fife, that nobleman promptly took the burden upon himself, and contributed the pecuniary assistance needed with the greatest liberality. Phillip had begun to succeed in his profession, and was becoming independent through his own exertions, but by the kindness of his friends he was enabled to go to London in 1836. He was soon admitted a pupil of the Royal Academy. In 1838 and 1839 his portraits, by which he had begun to maintain himself, were admitted to the exhibitions of the Academy. In 1841 he returned to Aberdeen, where he resided for seven years, pursuing his profession as a portrait-painter, but not abandoning the study of ideal art. In 1841 he exhibited a picture in the Royal Academy, but it failed to attract much attention. He had several pictures the same year in other metropolitan exhibitions. In 1842 he exhibited four pictures at the Royal Scottish Academy's exhibition in Edinburgh. During each successive year he continued to send pictures to the exhibitions until, in 1847, he returned to London. This year he exhibited at the Academy a picture which began to lay the foundation of his fame, Presbyterian Catechising. Though frequently dissatisfied with the position his pictures procured, he continued after this to send them regularly to the Academy. Drawing for the Militia (1842), Baptism in Scotland (1850), and the Free Kirk were among his most celebrated pictures at this period. In the autumn of 1851, his health beginning to fail, he went to Seville, where he spent seven or eight months. He visited Spain again in 1856–57, and in 1860–61, and Rome for about three months in 1866. During his first visit to Seville he bestowed special study on the works of Murillo and Velasquez, the latter of whom he especially admired. From this period a marked change in his style may be dated, and something of the rich colouring and brilliant treatment of the Spanish school are to be found in his subsequent works. He was introduced on his return by Sir Edwin Landseer to the queen, who ordered several pictures from his sketches. El Paseo, the Letter-writer of Seville, and the Spanish Contrabandistas were painted for the royal collection. Life among the Gipsies at Seville was exhibited at the Royal Academy in 1853, and at once commanded the admiration of critics. Numerous other pictures on Spanish subjects followed, together with a few portraits and Scotch pictures, among the best of which is Collecting the Offering in a Scotch Kirk. In 1858 he exhibited, besides the Contrabandista, Youth at Seville and the Daughters of the Alhambra; in 1859 The Huff, which procured his election as a member of the Royal Academy. His diploma work, Prayer, was exhibited the following year, along with the Marriage of the Princess Royal, painted for the queen. Among his pictures in 1863 were the House of Commons, 1860; and La Gloria, a Spanish wake. The Early Career of Murillo was exhibited in 1864, and a portrait of the Right Hon. Duncan MacNeill of Colonsay for the Parliament House, Edinburgh, in 1866. Two pictures illustrative of the Spanish lottery, The Purchase of the Tickets, and The Results of the Drawing, are said to have been the last from his easel. He died of paralysis, the result of a low fever, 27th February, 1867. The chief technical characteristics of Phillip's style as a painter may be said to be breadth of treatment and powerful colouring. In the last particular he was unsurpassed, and to these he added humour, pathos,

and a true appreciation of character. His flesh-tints are distinguished by their rich and healthy hue.

PHILLIPS, JOHN, LL.D., geologist, was born 25th December, 1800. He was the youngest son of a Welsh family, who held a small property in Carmarthenshire. His parents died early, and he was left under the guardianship of his uncle, William Smith, who early taught him the habit of geological observation. In his tenth year he entered the school of Holt Spa, in Wiltshire, where for five years he worked incessantly, his favourite studies being Latin, French, and mathematics. On leaving school he spent a twelvemonth with the Rev. Benjamin Richardson, of Farleigh Castle, near Bath, an excellent naturalist and enthusiastic admirer of rural life, who greatly contributed to cultivate Phillips' taste for like pursuits. He then returned to his uncle's house in London. Smith, who had a lucrative profession as a civil engineer, gave his whole spare time to geology, and was at this time occupied with his celebrated Map of the Strata of England and Wales. In this occupation, which so absorbed his interest as at length to prove fatal to his fortune, he was closely followed by Phillips, who assisted him both in his professional work and in his geological pursuits. In 1824 Phillips accompanied Smith to Yorkshire, where the latter had engaged to deliver a course of geological lectures, and from this time he became himself engaged in a round of similar occupations. The collections which he had already formed in natural history and palæontology brought his services into request to arrange museums and lecture on their contents. He visited most of the Yorkshire towns in this way, and formed valuable friendships in York, Scarborough, Hull, Leeds, and Sheffield. The liberal remuneration which he received for these studies he spent freely in improving his own scientific knowledge, thus laying the foundation of a wide acquaintance with the various branches of natural science, and making himself master in particular of the branches of zoology and geology. He subsequently visited Birmingham, Manchester, and Liverpool, and, when the British Association was formed in 1831, his operations had extended to University College, London. His permanent residence at this time was in Yorkshire, where he had charge of the Yorkshire Museum, and was secretary of the Yorkshire Philosophical Society. Phillips took a leading part in the formation of the British Association, and was active and energetic in his support of it, as assistant general secretary, a position he long continued to hold. The duties of arranging and editing the reports and of preparing for the annual meetings devolved on him in this capacity. He also took a prominent part in the lectures on special subjects adapted to general audiences. In 1834 Phillips was chosen a member of the Royal Society. He was appointed professor of geology in King's College, London, and afterwards in the University of Dublin. On the death of Strickland (1853) he was appointed deputy reader in geology at Oxford, and received the degree of M.A. On the death of Buckland (1856) he received the appointment of reader. In 1858–59 he was president of the Geological Society. He died at Oxford, 24th April, 1874.

Phillips' contributions to the literature of geology were numerous, comprising more than forty treatises between 1826 and 1866. They include contributions to the Encyclopædia Britannica, the Encyclopædia Metropolitana, and the Penny Encyclopædia, a Treatise on Geology in Lardner's Encyclopædia, &c. His Treatise on Geology from the Encyclopædia Britannica was published separately in 1840. Among his other works are: Illustrations of Geology, in two parts (1829 and 1836); Guide to Geology (1834); Figures and Descriptions of the Palæozoic Fossils of Cornwall, Devon, and West Somerset; The Rivers, Mountains, and Sea Coast of Yorkshire (1852); Life on the Earth (1861); Notices of Rocks and Fossils in the University Museum, London (1863).

PHILLIPS, THOMAS, an eminent portrait-painter, born in 1770 at Dudley, in Warwickshire, was early placed in Birmingham to learn painting on glass, and in 1790 came to London, where West employed him on the glass paintings in St. George's Chapel at Windsor. In 1792 he exhibited some historical pieces, but soon after turned his attention to portrait-painting, which yielded him as much applause and far more profit. In 1808 he became a member of the Royal Academy, and in 1824 he succeeded Fuseli as professor of painting. His lectures, which have been published (Lectures on the History and Principles of Painting, 1833), are in a clear and simple style, and tolerably instructive. In 1824 he made a tour to Italy. He died in 1845. After his success as a portrait-painter was established he confined himself almost entirely to that branch, and his fame rests upon it.

PHILO OF BYBLOS is identified by some authorities with Philo Herennius, mentioned by Suidas. The latter was born about the time of Nero, and lived to the reign of Hadrian. The former is mentioned by Eusebius as having translated the Phœnician History of Sanchoniathon into Greek. Herennius wrote a work on Hadrian's reign, and numerous other works.

PHILOCTETES, a Grecian hero, son of Pœas and Demonassa, celebrated for his skill in archery. He led the warriors of Methone, Thaumacia, Melibœa, and Olizon in the expedition against Troy; but having been bitten in his foot while he was offering sacrifice in the island of Chrysa, by a serpent which guarded the temple, he became, by the mortification of his wound, so offensive that he was sent back to Lemnos, and there dragged out nine miserable years in lamentations. But, according to the prophecy of Helenus, Troy could not be taken without the arrows of Heracles, and these were in possession of Philoctetes, to whom the hero had given them when he ascended his funeral pile. It therefore became necessary for the Grecians before Troy to recall Philoctetes. Ulysses, who had advised his exile, with Pyrrhus (according to some, Diomedes) undertook the embassy; the latter, by promising to heal his wound, prevailed upon him to return to Troy. He was cured by Machaon (or Æsculapius), and after many Trojans, among whom was Paris, had fallen by his arrows, the city was taken. The history of Philoctetes forms the subject of one of the tragedies of Sophocles. In the Homeric poems all that is told of Philoctetes is his being left at Lemnos in consequence of his wound, and returning home in safety; the other particulars have been added by the cyclic and epic poets. There are numerous other versions of the story, which each poet has adorned after his own fashion.

PHILO JUDÆUS, a philosopher or Theosophist who flourished at Alexandria in the first century of the Christian era. He went to Rome in A.D. 40 as one of a deputation from the Jews of Alexandria to the Emperor Caligula to persuade him to revoke the decree by which he compelled the Jews to pay divine honours to his statue. He was the oldest of five deputies. This and the fact that he visited Jerusalem, that he belonged to a wealthy family, and received a liberal education, is nearly all that is known of his life. The greater part of the writings of Philo have reference to the books of Moses. They consist of an account of the Mosaic narrative of the creation (De Mundi Opificio), allegorical expositions of other parts of Genesis, lives of Abraham, Joseph, and Moses, treatises on the Decalogue, Circumcision, Monarchy, First-fruits, Offerings, and other subjects.

Among his non-Mosaic works are a Treatise de Mundi Incorruptibilitate, and De Vita Contemplativa and Quod Omnis Probus Liber, which treats of the Essenes.

Before the time of Philo the hellenized Jews (see HELLENISTS), particularly those of Alexandria, had begun to blend the ideas of the Greek philosophers with the teaching of their own sacred books; but as they generally held that the Pentateuch itself was the source of inspiration from which the Greeks derived what was true in their philosophy, they did not borrow directly from them, but arrived at similar conclusions by allegorical interpretations of their own books, and even by the invention of spurious ones. It was in this Alexandrian school of hellenized Judaism that Philo was brought up. He did not even know the Hebrew Scriptures except through the Septuagint version. His philosophy was thus strictly a theosophy. It rested, as its direct foundation, on the Jewish Scriptures as an inspired revelation, and with these it incorporated the speculations of the writer, founded on the systems of Greek philosophy which best harmonized with the teaching of the Hebrew Scriptures, as Plato and Aristotle, in the form of comments on and deductions from the sacred text. There is neither much depth of original speculation nor much logical consistency or scientific completeness of system in Philo. On the other hand, he was not deficient in constructive power, and his works form the best representative of the Græco-Jewish philosophy.

Philo's idea of God was partly religious, partly philosophical. From his faith as a Jew he derived the principle that God is to be worshipped as a personal being, but in developing his conception of God he is indebted chiefly to philosophical speculations. He held that God is incorporeal and only cognizable by reason. He is the most universal of beings, and higher than knowledge, goodness, or beauty, *per se*. He has, strictly speaking, no attributes, being pure, unqualified being: he is therefore incomprehensible. The attributes ascribed to God in Scripture are to be understood only figuratively. God is present everywhere in the material universe by his operations; nowhere in his essence. God is the only free being. All others are subject to necessity. Philo's notions of matter are not remarkably consistent. He held God to be too perfect to have any association with it, yet he holds him to be the Creator of the universe. Matter, which has only an apparent existence, is the cause of all evil, as opposing resistance to the arrangements of the Creator. In its primeval state it is passive, lifeless, and destitute of quality or form. Between God and the world there is an intermediate being, the Logos. Philo wavers in his account of the Logos also. The Logos is the most universal of all beings except God. Philo personifies the Logos, but not so consistently as to render it certain that a distinct person and not a mere emanation or assemblage of attributes is intended. Thus he represents God as the source of light, the Logos as the nearest circle of light proceeding from it, and each separate power as a separate ray. The Logos contains in itself the sum of ideas—powers or spiritual forms which pervade the universe, and which are creative, governing, foreseeing, law giving, &c. These forms are also regarded as either qualities of the deity or distinct persons. Sophia, wisdom, is sometimes considered as the first of the potencies of the Logos, sometimes as the mother of the Logos. God created the world, as already indicated, by the agencies of these potencies, or of the Logos in whom they reside, out of unqualified matter. He gives the Logos the titles of Son of God, Paraclete, and Mediator between God and Man. Philo added an element of mysticism to his Platonic speculations. He held logic and physics to be inferior to metaphysics as a mental discipline, and the highest attainment of philosophy to be the intuition of God, which is attained through divine illumination by means of self-renunciation and the resignation of finite consciousness to the divine influence.

In interpreting Scripture Philo recognizes a double sense, the allegorical, which is the higher and more important, and the literal, which is not to be neglected. The anthropomorphic representations of God in Scripture he regarded as an accommodation to the sensual nature of man. Even in history the allegorical sense is never wanting; thus he divided the laws into unwritten laws, which are contained in living patterns, as Abraham, Isaac, Jacob, Moses, &c., and written laws, which are contained in particular precepts. It is a fundamental principle with him that the law, which emanates from the Being who is both the creator and the father of the universe, is in harmony with nature, and that he who violates it is punished by natural events. He who lives according to the law of Moses is a citizen of the world. He defended the outward observances of religion against those who would have reduced them to mere symbols. 'Although circumcision,' he said, 'properly symbolizes the removal of all passion and sensuality and impious thoughts, yet we may not therefore set aside the practice enjoined; for in that case we should be obliged to give up the public worship of God in the temple, and a thousand other necessary solemnities.'

The whole of Philo's works are not extant. Some treatises have been recovered by Angelo Mai and Baptist Aucher in palimpsests. Critics differ as to the arrangement of his Mosaic commentaries, and as to the fact of their having been originally continuous. Philo's works have been edited by Thomas Mangey (London, 1742), A. P. Pfeiffer (Erlangen, 1785–92; second edition, 1820), C. E. Richter (Leipzig, 1828–30). A stereotyped edition was published at Leipzig, 1851–53; and there are several editions of particular treatises. J. G. Müller, August Gfrörer, A. F. Dahne, Grossman, H. Planck, and numerous other scholars, have written on Philo.

PHILOLOGY. This word is the English form of the Greek *philologia*, and it formerly carried the same extensive signification; but it is now adopted to signify the science of language. It is difficult to define the signification of *philologia*, for it appears only to have been used in a vague sense to comprise all literature and some science. Thus grammar, rhetoric, logic, criticism, poetry, oratory, biography, and history, have all been included under the term. And all science that was not philosophy, in the Greek sense of that term—all, indeed, that could not be comprised within the limits of philosophy, was embraced under the general term of philology; so that philology became a refuge for all that philosophy excluded, rather than a defined division of general knowledge. It will be seen that the subjects comprised under the term philology were not united by any bond of common characteristics, but by the sole circumstance that they were not philosophy. They might be highly philosophical, as the masterly treatises of Aristotle on logic and rhetoric have universally been deemed to be; but if they were not philosophy they were thrown beyond its boundary, to find a refuge under the general term of philology. A person skilled in philology was called *philologos*, a term which corresponds to our philologist, philologian, or philologer, only these terms, in modern times, have shared in the limitation of meaning which, as already remarked, the word philology has undergone.

The Romans adopted much from the Greeks. Cicero admired and deeply studied the Greek language, philosophy, and literature. He did much to

make Greek learning fashionable in Rome. Cicero divided his writings into two classes; the orations constituted one class, and all his other works the other, which he denominated philological. Several of his treatises, as that on the nature of the gods, are philosophical, but he wrote nothing on philosophy itself; so that his classification is after the Greek model; yet he felt that his orations were not philology, and he placed them by themselves, apart from both philosophy and philology.

After the revival of letters the learned men of Europe adopted the terms and distinctions of Greek philosophy and literature; and some adopted the term *philologus*, which is found under the engraved portraits of distinguished scholars of the period. The reader will observe, however, that the learned men of Europe adopted the word *philologus* in a different sense from what the word signified in Greece and in Rome. In Greece the term was applied to a man who was learned in the grammar, criticism, and literature of his mother-tongue. It was the same in Rome. But in Europe all the learning in his mother-tongue would count for nothing; he must be learned in two foreign languages in order to be deemed a *philologus*. The Greeks called all languages but their own barbarous. So did the Romans. The learned men of Europe, with strange inconsistency, agreed with both the Greeks and the Romans to stigmatize all other languages as barbarous, and, by way of contrast, both were termed learned languages. No doubt nearly all secular learning at the revival of letters was contained in the Greek and Latin languages; but, as Mr. Cobbett acutely remarked, that circumstance does not make the languages learned.

The subjects comprised under the term philology have each been so studied, developed, and expanded by modern inquiry as to become great centres of knowledge. Thus the antiquarian studies other antiquities, writings, numismatics, chronology, and history than those of Greece and Rome. The growth of these several subjects into large dimensions, and their characteristics being so different from what they were when limited to the things of Greece and Rome, have together led to the disuse of the term philology in its old sense; and the study of languages having assumed a character and importance which it never before possessed, the new science—for such the philosophy of language is—has received the name of philology. This term, however, has not yet obtained undisputed title to name the new science, for others are also adopted. Sir John Stoddart proposed the terms glossology and glossography; but as these could name only the lexical, to the exclusion of the grammatical part, they have not been received. The terms linguistic science and linguistics, although not much in use in Great Britain, are frequently heard on the Continent. The objection to the terms is, that a man who is able to read and write several languages is designated a linguist. Now a man may be a good linguist, and yet care nothing to know the philosophy and genealogy of languages. He may be able to read and write a number of different languages, but yet have no interest in tracing the relationship of one language to another, or in speculations on the origin of language. The term linguist, then, already appropriated to a man who is skilled in languages, leaves the term philologist as a designation for him who studies languages in order to trace their relationships and genealogies, and the allied word philology is the name for the science. The establishment in London, in 1844, of a society for the advancement of philological science, and named by the founders the Philological Society, and the convenience of having the science named by one word, and that a substantive, will probably induce the learned to agree in recognizing the term philology as the name of the science whose aim is to develop the philosophy of language.

Philology has a wide scope; for it aims at describing all the languages now spoken on the earth—at determining their affinities and relationships to each other—at tracing the antecedent languages of each living speech up to its first ancestral language—at determining the affinities and relationships of those antecedent and ancestral languages to each other—to make out the genealogy of each, and thus to arrive at a knowledge of the natural history of language. The philologist feels as much interest in classifying languages into family groups as the zoologist does in classifying animals into family groups. But however great may be the interest which attaches to a knowledge of languages, the philologist feels that such knowledge has a greater interest and a higher value when applied as a means to an end—as a means to solve important questions in philosophy, in history, and in ethnology.

The history of philology is like that of other sciences—its origin, a few facts obtained by empirical observation, which were slowly augmented by others gained in a similar manner, and the whole remaining a crude undigested mass for a long time before appropriate ideas were brought to bear upon them to bring them into shape. But as soon as these ideas were applied the empirical facts were verified and reviewed with a purpose, the signification of the facts was understood, and similar facts were sought after in other languages. The facts brought to light by these researches were examined in relation to those previously known, and all in relation to the ideas that were supplied by the philologist. The facts were analyzed and classified, new principles were seen, laws were discovered, and the accumulated knowledge gradually assumed the characters of a classificatory science. As the space assigned to the article PHILOLOGY does not allow room to fill in this sketch with the historical details, we shall refer to a few authorities to enable the reader to collect them for himself. In the Restitution of Decayed Intelligence in Antiquities, by Richard Verstegan (1605), the reader will find profound views on the value of philology in determining questions of history and ethnology. Verstegan was a Teutonic scholar of a large range of languages, comprising the living Scandinavian tongues. He was anxious to compare the German and Persian languages, in order to determine the question then mooted of the Persian origin of the Germans. He took great pains to obtain a Persian vocabulary for the purpose, and at last depended on a comparison made for him by a friend in Italy in 1601. On that information, although he found certain words to be alike, he decided that the German is not descended from the Persian. He considered the Persian to be no more connected with the Latin, although certain words are common to those tongues, than the Latin and Welsh, and 'broken Latin words' are found in the Welsh language. He says he has heard that Hebrew words are found in the Irish language, but not enough to make the Irish to be 'good Hebricians.' His comparison of the English and Dutch languages, in order to exhibit a 'nearness of speech,' and his comparison of the Persian and Latin by means of the first five verses of the first chapter of Genesis, in order to exhibit a 'farness of speech,' are specimens of lingual comparison made in the earliest period of the history of philology. Verstegan was a traveller, and obtained his knowledge of the languages by residence in the countries in which they are spoken. He was not a mere linguist. He maintained that England was originally connected with France by continuous land from Boulogne to Dover, and his arguments

are precisely those of the geologists of the present day.

It was just a century after Verstegan that the celebrated memoir of Leibnitz was read in the Academy of Sciences at Berlin. The principal object of Leibnitz in founding that Academy was, as his memoir of 1700 states, 'to insure the progress of the philosophy and classification of languages, and by that means to trace the genealogy of mankind.'

The Hermes of James Harris, published in 1751, is a treatise on grammatical philosophy, especially in reference to the Greek and Latin grammarians. This important book was followed by the ΕΠΕΑ ΠΤΕΡΟΕΝΤΑ, or the Diversions of Purley, in 1777, by John Horne Tooke. This remarkable book on English etymology forms an epoch in philological science. For the first time etymology was investigated by the inductive method, collecting facts from all the languages which are the source of the English language. This great work was published about the same time as the Monde Primitif, analysé et comparé avec le monde moderne, considéré dans l'histoire naturelle de la parole. Par M. Court de Gebelin (nine vols. 4to, 1774–82). In this voluminous work on universal grammar the author attempted to classify the roots of words having the same signification, which he had collected through a wide range of languages. These original works indicate the attention that was devoted to philology in the latter half of the eighteenth century. It was at this time that Halhed, Wilkins, and a few others in the East India Company's service, were acquiring the knowledge of a language unknown till then to European scholars, but which was destined to effect a revolution in philology. That language was the Sanskrit. Sir William Jones proceeded to India in 1783. He was eminently qualified to appreciate the importance of a knowledge of the Sanskrit to philology, as well as to the civilians of India, and he entered upon its study with his usual ardour. He was one of the founders and first president of the Asiatic Society of Bengal. The affinity of the Sanskrit to Latin and Greek is so patent to observation that it was impossible for such scholars as Halhed, Wilkins, and Jones not to perceive it; and, accordingly, we find that these pioneers in Sanskrit announced its close affinity to them. The Persian scholars as soon found it to be allied to Persian, and German scholars to German. In the Edinburgh Review, January, 1809, is an able article on Philology, in a review of Wilkins' Sanskrit Grammar, written by the late Rev. W. Conybeare, M.A., which well marks the state of our knowledge of the Indo-Germanic languages at that period. In 1813 appeared Dr. Prichard's Researches into the Physical History of Man.

In this great work, from which modern ethnology may be dated, Dr. Prichard, speaking of the comparative vocabulary of the Sanskrit, Persian, Latin, and German languages in Mr. Conybeare's article, says, 'But the proof would have been more striking if he had added the Celtic and Slavonic dialects and the Greek. I have made an attempt to supply the deficiency, which I intend shortly to make public.' In 1831 Dr. Prichard's announced work was published, under the title of the Eastern Origin of the Celtic Nations proved by a Comparison of their Dialects with the Sanskrit, Greek, Latin, and Teutonic Languages. The group of languages had borne the name of Indo-Germanic languages, but now that Dr. Prichard had proved the Celtic dialects to belong to the same group, the name of the group was changed to Indo-European. In 1833 appeared the first part of Professor Bopp's Comparative Grammar of the Sanskrit, Zend, Greek, Latin, Lithuanian, Slavonic, Gothic, and German Languages, which was completed in 1837. It has reached a third edition, and been translated into English and French. This elaborate work has met with a hearty welcome from scholars in all countries. It is a most learned work, and indispensable to the philologist. It is based on the assumption that the Sanskrit is the most ancient of those languages. Bopp has also written on the Celtic dialects as members of this family of tongues. The Celtic dialects are doubtless much older than the Sanskrit. The opinion now current is that all these tongues are sister dialects of a lost ancestral language. We shall not occupy space by an enumeration of all the eminent philologists who have contributed towards our present accurate knowledge of the philosophy of this family of languages. It is too large a list for a popular view of philology.

It is familiarly known that the grammar and lexicon together contain a language. Now the philologist compares grammar with grammar and lexicon with lexicon. This comparison cannot be successfully made by those who are ignorant of the languages to be compared. Some authors, however, deem a very slight acquaintance with the languages to be sufficient, while others consider it necessary to know the languages well—indeed, so well as to be able to write them—before a man is qualified to institute such a comparison. It is quite certain that we rely with more confidence on comparisons made by competent scholars in the languages compared than we do on comparisons made by those only slightly acquainted with the languages. A comparison of languages displays four clearly-marked relationships among them, namely:—

1. Those which have a similarity of grammatical forms, combined with a considerable number of primitive words or roots common to them, or so resembling each other in sense and sound as manifestly to be of the same origin. Such languages are nearly related to each other, as those constituting the Indo-European family of tongues, and those constituting the Shemitic family of tongues.

2. Those which have but few words in common, and yet display a remarkable analogy in their grammatical forms, as the languages of the American Indians and the monosyllabic languages of the Chinese and allied tongues.

3. Those which have but little likeness in their grammar, and yet have a vocabulary in common for the physical objects of nature, as sun, moon, &c.; for domestic animals, for parts of the body, for family relationships, &c., indicate an ancient alliance. A correspondence of words for certain objects, actions, and conditions may arise from conquest, transplantation of population, from the introduction of a new system of religion; but such correspondence, although it may embrace the whole vocabulary of the stock of ideas so introduced into a country, will extend no farther, and will not interfere to any great extent with the primitive words for sun, moon, &c., before-named. Islamism has introduced a vast vocabulary of religious terms from the Arabic language into those of Turkey, Persia, and the Mohammedan countries of Africa. A considerable vocabulary of French military terms has been introduced into every other European language. A vocabulary of English commercial and also of engineering terms has been distributed over Europe.

4. There are languages in which, although neither glossorial nor grammatical likeness can be traced, yet there are certain resemblances which appear to be too numerous and striking to be the result of accidental coincidence. M. Klaproth hypothetically terms this connection *antediluvian*.

Before proceeding to display the affinity of the leading languages which constitute the Indo-European

family, it is necessary to describe Grimm's law of the correspondence of consonants in the Teutonic dialects. It is called Grimm's law because he was the first to perceive and develop this law. Grimm discovered that a Greek *p* is displaced and an *f* appears in its place in the Gothic, while a *v* takes its place in the Old High German. Thus the Greek *podos* corresponds to the Gothic *Fotus*, and to the Old High German *Vuoz*, a foot. Grimm's law is subjoined:—

Labials.

Greek,	p,	b,	f.
Gothic,	f,	p,	b.
Old High German,	b (v),	f,	p.

Linguals.

Greek,	t,	d,	th.
Gothic,	th,	t,	d.
Old High German,	d,	z,	t.

Gutturals.

Greek,	k,	g,	ch (χ).
Gothic,	kh (h-g),	k,	g (h).
Old High German,	g (h),	ch,	k.

We shall give one example of each of these correspondences as an illustration of the law:—

Labials.

Greek,	Patēr,	Phero.
Gothic,	Fadrein,	Baira.
Old High German,	Vater, (*Father*)	Piru. (*to Bear.*)

Linguals.

Greek,	Tu,	Duo,	Thugatēr.
Gothic,	Thu,	Tva,	Dauhtar.
Old High German,	Du, (*Thou*)	Zuei, (*Two*)	Tohtar. (*Daughter.*)

Gutturals.

Greek,	Kardia,	Gonu,	Chēn.
Gothic,	Hairto,	Kniu,	Gans.
Old High German,	Herza, (*Heart*)	Chniu, (*Knee*)	Kans. (*Goose.*)

Professor Bopp extended Grimm's law to the Zend, Lithuanian, and Slavonic languages; and Dr. Prichard extended it to the Celtic. It is unnecessary to describe these extensions in a popular treatise. The languages composing the Indo-European family are the Sanskrit, Zend, Persian, Greek, Latin, Lithuanian, Teutonic, Slavonic, and Celtic. There are no maps of the geographical areas occupied by these languages. The areas now occupied by them are nearly those which they occupied at the dawn of history, and their relative position is undoubtedly the same. The Sanskrit area was North India; the Zend and Persian, Persia; the Greek, Greece; the Latin, Italy; the Lithuanian, the small tracts of land abutting on the south-east corner of the Baltic Sea, comprising Livonia, Courland, and Eastern Prussia; the Teutonic, the present area of the German and Scandinavian languages; the Slavonic, from the Black Sea northwards to Lake Ladoga, and from Venice eastwards to the Volga; and the Celtic, the west of Europe, including Britain. Such is a general outline of the areas and relative positions of the Indo-European family of languages. Those of the languages which are no longer vernacular have living representatives, as the Latin, whose descendants are the Italian, Spanish, Portuguese, and French. The Latin, however, is not only the head of a sub-group of descendants. It was formerly one of a group of sister languages which contemporaneously occupied Italy, as the Oscan, Umbrian, Messapian, Sabellian, and perhaps the Etruscan. We shall not have space to enumerate the contemporaneous and descended dialects of the several languages which constitute the Indo-European family. We now proceed to cite selected words from those languages, in order to show that they possess a vocabulary of primitive words in common, but slightly varied in form in each, the variation being that of pronunciation, and represented by the correspondence of consonants as above described.

1. Words denoting persons and family relationships:—

MAN.

Sanskrit,	Virah, a hero.	Gothic,	Vair.
Zend,	Vairya.	Irish,	Fear.
Lithuanian,	Vyras.	Welsh,	Gwr.
Latin,	Vir.	Greek	(F)ērōs.

FATHER.

Sanskrit,	Pitar.	Slavonian,	Bat.
Zend,	Paitar.	Gothic,	Fadrein
Persian,	Pader.	Old High German,	Vatar.
Greek,	Patēr.	German,	Fader.
Latin,	Pater.	Irish,	Athair.[1]

MOTHER.

Sanskrit,	Matar.	Slavonian,	Mater.
Zend,	Matar.	Lithuanian,	Motina.
Persian,	Mader.	German,	Mutter.
Greek,	Mētēr.	Irish,	Mathair.
Latin,	Mater.		

SON.

Sanskrit,	Sunus.	Gothic,	Sunus.
Lithuanian,	Sunus.	German,	Sohn.
Slavonian,	Syn.		

DAUGHTER.

Sanskrit,	Duhitar.	Lithuanian,	Duhter.
Zend,	Dughdhar.	Gothic,	Dauhtar.
Persian,	Dokhter.	German,	Tochter.
Greek,	Thugatēr.	Irish,	Dear.
Slavonian,	Dotcher.		

The preceding words are given merely as specimens. The list may be extended to include the words woman, brother, sister, father-in-law, mother-in-law, son-in-law, daughter-in-law, brother-in-law, and some others. On reference to the specimen words above it will be seen at once that the word for man as hero is the same word in all the languages, but existing in variant forms.

2. Words denoting parts of the body:—

EYE.

Sanskrit,	Akshi.	Latin,	Oculus.
Zend,	Asi.	Gothic,	Augo.
Lithuanian,	Akis.	German,	Auge.
Slavonian,	Oko.	Danish,	Oje.

TOOTH.

Sanskrit,	Dantas.	Gothic,	Thuntus.
Persian,	Dendan.	Danish,	Tand.
Lithuanian,	Dantis.	Irish,	Dend.
Greek,	Odontos.	Welsh,	Dant.
Latin,	Dens (gen. Dentis).		

KNEE.

Sanskrit,	Janu.	Latin,	Genu.
Zend,	Jenu.	Gothic,	Kniu.
Persian,	Zanu.	O. H. German,	Chniu.
Greek,	Gonu.	German,	Knie.

A list of such words might be extended to include brow, nose, voice, head, hair, ear, nail, foot, body, udder, navel, heart, blood, tear, and some others.

3. Words denoting animals:—

CATTLE.

Sanskrit,	Pas'u.	Gothic,	Faihu.
Zend,	Pasu.	Slavonic,	Pasu.
Greek,	Pōu.	O. H. German,	Vihu.
Latin,	Pecus.	German,	Vieh.
Lith. (Old Prussian),	Pecku.		

SHEEP.

Sanskrit,	Awis.	Gothic,	Avi.
Latin,	Ovis.	Anglo-Saxon,	Eowu.
Greek,	Ois.	English,	Ewe.
Slavonic	Owza.	Irish,	Aoi.
Lithuanian,	Awis.		

[1] There is evidence to show that the initial consonant of *Athair* is lost.

GOOSE (Gander).

Sanskrit,	Hansa.	Lithuanian,	Zasis.
Persian,	Kaz.	O. H. German,	Kans.
Greek,	Chēn.	German,	Gans.
Latin,	Anser.	Irish,	Geadh.
Slavonic,	Gusi, gansior.	Welsh,	Gwyz.

A long list of such words may be made, as ox, cow, dog, horse, ass, wolf, mouse, goat, ram, hog, sow, duck, swan, worm, fly, and some others.

4. Physical objects of nature:—

LIGHT.

Sanskrit,	Aloka.	Gothic,	Liuhath.
Greek,	Lukē.	German,	Licht.
Latin,	Lux (lucis).	Welsh,	Lhwg.
Slavonic,	Luc.	Irish,	Leos.

SUN.

Sanskrit,	Hailia.	Lithuanian,	Saule.
Greek,	Hēlios.	Gothic,	Sauil.
Latin,	Sol.	Irish,	Saule.
Slavonic,	Solnze.	Welsh,	Haul.

SEA.

Sanskrit,	Mirah.	Gothic,	Marei.
Latin,	Mare.	German,	Meer.
Slavonic,	More.	Irish,	Muir.
Lithuanian,	Mares.	Welsh,	Mor.

This list might include sky, moon, star, earth, water, fire, day, night, cloud, and some others.

5. Adjectives:—

GREAT.

Sanskrit,	Mahat.	Latin,	Magnus.
Zend,	Mazo.	Gothic,	Mikels
Persian,	Mih.	Irish,	Meall.
Greek,	Mega.		

BROAD.

Sanskrit,	Prathus.	Scandinavian,	Flatr.
Greek,	Platus.	Latin,	Latus.
Lithuanian,	Platus.		

YOUNG.

Sanskrit,	Yuvan.	Lithuanian,	Jaunas.
Persian,	Juan.	Gothic,	Jungs.
Latin,	Juvenis.	German,	Jung.
Slavonic,	Januii.	Welsh,	Jau, Jeuant.

This list might include ample, heavy, full, saturated, long, thin, light, new, warm, dry, middle, red, white, widowed, holy, all, other, high, and many others. We add the numerals up to ten:—

	Sanskrit.	Zend.	Old Slavonic.	Lithuanian.	Welsh.	Greek.	Latin.	Mœso-Gothic.
1.	eka.	aēva.	yedin.	wiena.	un.	Heis (neuter, Hen).	unus.	aina.
2.	dwau.	dva.	dva.	du.	dwy.	Duō.	duo.	twai.
3.	tri.	thri.	tri.	tri.	tri.	Treis.	tres.	threis.
4.	chatur.	chathru.	chetyri.	keturi.	pedwar.	Tettares.	quatuor.	fidvor.
5.	panchan.	panchan.	pyaty.	penki.	pump.	Pempe.	quinque.	fimf.
6.	shash.	ksvas.	shesty.	szeszi.	chwech.	Hex.	sex.	saihs.
7.	saptan.	haptan.	sedmi.	septyni.	saith.	Hepta.	septem.	sibun.
8.	ashtan.	astan.	osmy.	asztuni.	wyth.	Oktō.	octo.	ahtan.
9.	navan.	navan.	devyaty.	dewyni.	naw.	Ennea.	novem.	nihun.
10.	das'an.	dasan.	desyaty.	deszint.	deg.	Deka.	decem.	taihun.

The numeral 1 is not common to these languages, but the other nine are expressed by words common to all. In the ordinal numbers, however, the word for the first is the same in all, only varied in form, as—

First.	prathama.	frathema.	pervaya.	pirma.	prif.	prōta.	prima.	fruma.

6. Personal pronouns:—

I.

Sanskrit,	Aham.	Lithuanian,	Asz.
Zend,	Azem.	Old Slavonic,	Az.
Greek,	Egōn.	Gothic,	Ik.
Latin,	Ego.	Welsh,	Mi.

The nominative singular of the personal pronoun *I* is formed from a different root to that which is the base of the oblique cases *mine* and *me*. It is well known to be so in Greek and Latin, and it is so in all the languages of this family except the Celtic, in which the same base originates all. The evidence is conclusive that the root of *ego, I*, is more recent, as a pronoun, than the root of *mou, mei, me*, and hence the Greek verbs in *mi* are older in form than those in *ō*.

THOU.

Sanskrit,	Tuam.	Lithuanian,	Tu.
Zend,	Tum.	Old Slavonic,	Ty.
Greek,	Tu.	Gothic,	Thu.
Latin,	Tu.	Welsh,	Ti.

WE.

Sanskrit,	Vayam.	Lithuanian,	Mes.
Zend,	Vaem.	Old Slavonic,	My.
Greek,	Hēmeis, Ammes.	Gothic,	Veis.
Latin,	Nos.	Welsh,	Ni.

YE.

Sanskrit,	Yuyam and Yushme.	Lithuanian,	Jus.
Zend,	Yuschem and Yus.	Old Slavonic,	Vy.
Greek,	Humeis, Ummes.	Gothic,	Yus.
Latin,	Vos.	Welsh,	Chwi.

The pronouns of the third person singular in the nominative case are lost; the oblique cases, however, remain, and possibly from them the lost nominative might be reconstructed. We therefore pass over the third person in both numbers. The study of pronouns is of high importance in philology. They have to be studied as a part of the glossary and also of the grammar of a language. The study of the one must be accompanied by that of the other. In the inflection of verbs the pronouns are represented, and in some languages, particularly those of the Shemitic family, the fragments of the pronouns that enter into the structure of the composite word are easily recognized. In the Indo-European languages they have in part been satisfactorily shown by the researches of Bopp and Prichard. A brief description and illustration of the more obvious fragments will be given in treating of the comparison of the grammars of these languages.

7. Verbal roots:—

TO DIE.

Sanskrit,	Mriyatai.	Gothic,	Maurthr.
Zend,	Mrithyn.	German,	Mord.
Latin,	Mori.	English,	Murder.
Slavonic,	Mrijeti.	Irish,	Marbh (dead).
Lithuanian,	Mirti.	Welsh,	Marw.

TO BE BORN.

Sanskrit,	Jajanti.	Lithuanian,	Gemu.
Zend,	Zazami	Gothic,	Keina.
Greek,	Gennaō.	Welsh,	Geni.
Latin,	Genero (to beget).	Irish,	Geinim (to beget).

TO STAND.

Sanskrit,	Tishtami (I stand, from root Stha).	Slavonic,	Stati.
		Lithuanian,	Stoweti.
Zend,	Histami.	Gothic,	Standan.
Greek,	Histēmi, Staō.	Irish,	Stadam.
Latin,	Sto.	Welsh,	Eistedh (to sit).

TO EAT.

Sanskrit,	Admi (I eat).	Lithuanian,	Edmi.
Greek,	Edō	Gothic,	Itan.
Latin,	Edo, esu.	Welsh,	Yeu, or Esu.
Slavonic,	Jamj, for Jadmi.	Irish,	Ithim (I eat)

The verbs to live, know, see, hear, think, go, sink, carry, bear, make, give, place, drink, thirst, heat, fear, plough, increase, strew, mix, be, and others, might be added.

8. Particles, or indeclinable words:—

The particles include adverbs, conjunctions, and prepositions. A few of these words are common to the several languages of their group, but in general particles are grammatical developments of individual tongues, or of the chief tongue of a sub-group of tongues.

AROUND.

Sanskrit,	Abhi.	O. H. German,	Umbi.
Greek,	Amphi.	German,	Um.
Latin,	Amb, but in composite words *am*, as in *am-plector*, &c.	Welsh,	Am.

WITH.

Sanskrit,	Sum.	Latin,	Cum.
Greek,	Sun.	Welsh,	Cyn.

ABOVE, OVER.

Sanskrit,	Upari.	O. H. German,	Ubar.
Greek,	Huper.	German,	Uber.
Latin,	Super.	English,	Over.
Gothic,	Ufar.		

It is unnecessary to extend the list. The preceding examples, from the vocabularies of the several tongues, are specimens from a vast amount of evidence, which necessitates the conclusion that the words for primitive ideas and common things are common to all the languages of the group. Let us proceed to the grammar.

The grammatical forms of words consist of the changes which words undergo in the two processes called declension and conjugation. Substantives, adjectives, and pronouns are declined, but verbs are conjugated. The general term inflection comprehends both declension and conjugation. In some languages the changes to which a word is subjected in inflection are very numerous, in others less so, and in some there are scarcely any. The Latin word *gladius*, the sword, for example, suffers certain changes at its end to express certain ideas of relation, which in English are expressed by separate words, thus:—

Singular.

Nominative case,	Gladius,	the sword,
Genitive ,,	Gladi-*i*,	*of the* sword.
Dative ,,	Gladi-*o*,	*to the* sword.
Accusative ,,	Gladi-*um*,	*the* sword.
Vocative ,,	Gladi-*e*,	*O* sword!
Ablative ,,	Gladi-*ō*,	*from the* sword.

Plural.

Nominative case,	Gladi-*i*,	the swords.
Genitive ,,	Gladi-*orum*,	*of the* swords.
Dative ,,	Gladi-*is*,	*to the* swords.
Accusative ,,	Gladi-*os*,	*the* swords.
Vocative ,,	Gladi-*i*,	*O* swords!
Ablative ,,	Gladi-*is*,	*from the* swords.

It will be observed that the final *i* in the genitive case singular is equivalent in meaning to the English words *of the;* and so of the other parts of the Latin word and the English words which are printed in italics. The part of the word which remains unchanged is called the root, and the other, the movable part, is the inflection. It will be observed that the nominative, like the other cases, consists of these two parts, gladi-*us*, so that *us* is the nominative ending of the word, just as *um* is the accusative ending. It is proper to remark that the root cannot of itself stand as a word; it must have a case-ending in order to take its place in a sentence. Some languages have many cases, and others very few. The Sanskrit has two more than the Latin, namely, the instrumental and the locative cases. The Greek has only five, as it lacks the ablative case. The English has only two, the nominative and possessive; its pronouns, however, have a third, called the objective. The Suomi, or language of Finland, has fifteen cases, and one of its dialects, the Syrjanian, has sixteen.

A successful comparison of the grammatical forms of nouns can only be made by those who are familiar with the declensions in the languages to be compared, who are familiar with the laws of euphony in each, and with the correspondence of consonants. We shall attempt to display the identity of grammatical declension by citing a noun in the accusative and genitive cases singular. The characteristic of the accusative is *m* in the Sanskrit, Zend, and Latin; in Greek the *m* is softened to *n*. In the Lithuanian the *m* has become weakened to be something like the French nasal of the word *on*:—

WOLF.

The accusative case in	Sanskrit,	Vrikam.
,, ,,	Zend,	Vehrkem.
,, ,,	Greek,	Lukon.
,, ,,	Latin,	Lupum.
,, ,,	Lithuanian,	Wilkam.
,, ,,	Gothic,	Vulf

The Gothic has lost the ending.

The characteristic sign of the genitive case singular is *s*. It is not affirmed that the genitive case of every declension ends in *s*, for boys in the lowest form know that in Latin there are genitives in *æ*, *i*, *is*, *us*, and *ei*.

WOLF.

The genitive case in	Sanskrit,	Vrikasya.
,, ,,	Zend,	Vehrkahe.
,, ,,	Greek,	Lukou.
,, ,,	Latin,	Lupi.
,, ,,	Lithuanian,	Wilko.
,, ,,	Gothic,	Vulfis.
,, ,,	English,	Wolf's.

The *h* in Zend corresponds to the *s* in Sanskrit. The *s* in the Lithuanian is lost.

The declensions of adjectives and pronouns are very similar to those of substantives.

It would require a volume to discuss the conjugation of the verb. We shall cite a verb in the present tense of the indicative mood, because the root is inflected only by the fragments of words expressive of personal distinctions, and is unencumbered with those that express time and mood. We select the substantive verb *to be* as convenient and sufficient to display the fact that the same root is inflected by means of the same suffixes:—

TO BE. Present Tense.

	First person.	Second person.	Third person.
1. Sanskrit.			
Singular,	asmi.	asi.	asti.
Plural,	smas.	stha.	santi.
2. Zend.			
Singular,	ahmi.	ahi.	asti.
Plural,	hmahi.	stha.	henti.
3. Greek (archaic forms).			
Singular,	emmi.	essi.	esh.
Plural,	eimes.	este.	enti.
4. Latin.			
Singular,	sum.	es.	est.
Plural,	sumus.	estis.	sunt.
5. Slavonian.[1]			
Singular,	yesm'.	yesi.	yest'.
Plural,	yesmi.	yeste.	yesut.
6. Lithuanian.			
Singular,	esmi.	essi.	esti.
Plural,	esme.	este.	enti.
7. Gothic.			
Singular,	im.	is.	ist.
Plural,	siyum.	siyuth.	sind.

[1] The initial *y* of the Slavonian represents the Slavonic habit of softening the utterance of initial vowels.

8. Persian.

Singular,	am.	iy.	est.
Plural,	im.	id.	end.

9. Irish.

Singular,	is mi.	is tu.	is e.
Plural,	is sinn.	is sibh.	is iad.

The suffixes are fragments of pronouns. It would occupy too much space to enter upon the discussion of the facts on which this opinion is based; but it may be stated that in the Welsh language a separate pronoun of the third person plural exists, namely, *hwynt*, which is found in an abbreviated form in the third person plural in all the tenses, as *carent*, they did love; *carasant*, they have loved; *carasent*, they had loved: *carant*, they shall love; *carant*, let them love. The final *nt* is the characteristic of the third person plural, and this *nt* is also the characteristic of the third person plural in all the Indo-European languages. The *nt* of the Welsh tenses is a fragment of *hwynt*, the pronoun *they*. Hence the *nt* in the other languages is a fragment of the same pronoun, which must formerly have existed in the ancestral language of this family. The pronoun *hwynt* (they) is now found in the Welsh alone. The preservation of this pronoun appears to be due to the circumstance that there is no present tense in attributive verbs, the tense being supplied by a circumlocution or phrase, like the English *I have written*, which necessitates the adoption of the pronoun in its separate state; and in the passive voice there are no person-endings to verbs, so that the pronoun, being continually in use, was not so likely to be lost as it was in the other Indo-European languages.

It will be observed that the original name for this group of languages, Indo-Germanic, was a very imperfect one, for it did not include the Persian, the Greek, and Latin, besides which it is a cumbrous compound. The amended name, Indo-European, is as cumbrous, and, as a name, is insufficient for the Asiatic languages of the group, and too much for the European languages. It is, however, quite commonly used. Professor Bopp adopts the term Sanskritic languages, Max Müller and many others, the term Aryan languages.

The Shemitic Languages.—Languages allied to the Hebrew are grouped with it under the general title of the Shemitic languages. This name was suggested by the passage, "Unto Shem also, the father of all the children of Eber, the brother of Japheth the elder, even to him were children born." Then follows the genealogy (Gen. x. 21, *et seq.*) The peoples of Palestine, Phœnicia, Syria, Mesopotamia, and Arabia all spoke Shemitic languages. These countries are in geographical contiguity, and constitute a large area in Western Asia, which stretches from the eastern shore of the Mediterranean Sea to the Tigris, and from the mountains of Armenia to the southern shores of Arabia. From this area Shemitic languages spread themselves into Africa and Europe, thus the Arabic passed over the Red Sea, and established itself in Æthiopia; and the Phœnician spread itself over the shores of the Mediterranean Sea, as well as over several of its islands. As the peoples of those countries are chiefly descended from the patriarch Shem, the term Shemitic languages is an appropriate name for the group.

The Shemitic family of languages consists of three principal divisions, namely, 1. The Arabic, of which the Himyaritic in South Arabia and the Æthiopic are ancient dialects. 2. The Aramæan, which is called Chaldee as it exists in the book of Daniel and the Targums, and is the Syriac of the early Christians. And 3. The Hebrew, with which the Phœnician, including the Punic, is closely allied, if not identical, and the Assyrian and Babylonian, which also are closely allied to the Hebrew. The Samaritan language is, as might be supposed, a mixed language, for when "the king of Assyria took Samaria, and carried Israel away into Assyria, and placed them in Halah and in Habor by the river of Gozan, and in the cities of the Medes (2 Kin. xvii. 6), he brought men from Babylon, and from Cuthah, and from Ava, and from Hamath, and from Sepharvaim, and placed them in the cities of Samaria instead of the children of Israel (ch. xvii. 24). The descendants of these mixed peoples were called Cuthim by the Jews, probably from a predominance of the men of Cuthah. And it is stated by Nicholls that 'a great number of Cuthean words, imported, doubtlessly, by the colonists,' are found in the Samaritan, but the lexicon and grammar prove the language to be essentially Shemitic. An excellent account of the Samaritans by Rev. John W. Nutt is prefixed to his edition of Fragments of a Samaritan Targum (London, 1874).

The Shemitic languages have peculiarities, both lexical and grammatical, which constitute their distinctive character, and widely separate them from the Aryan and all other languages. The characters in which these languages are written being known to few but Shemitic scholars, they have been transliterated into ordinary Roman type, in order to enable the mere English scholar to follow the stated facts.

The Shemitic languages are written, and consequently read, from right to left, except the Assyrian, Babylonian, and Æthiopic, which are read, as the English, from left to right. And these three languages are not written by means of letters, but by characters which represent syllables. It may be difficult to study a language apart from the method adopted in writing it, but the oral, not the written language, is what the philologist aims at as an object for comparison and study, thus the word *Melek*=a king whether it be written in Hebrew or Arabic letters, with or without the vowel-points, to express the vowels, or whether it be written in Assyrian syllabic cuneiform characters, or whether it be written, as in Hebrew, from right to left or as in Æthiopic from left to right, the object of the philologist is to arrive at the dissyllabic word *melek*, and to studiously trace it in those languages.

The Hebrew being more generally known than any other of the Shemitic languages, and being a good type of them, may be taken as a standard for comparison. Hebrew grammarians, both native and foreign, since the time of Rabbi Jehuda Hayug at the end of the tenth century of our era, have adopted his view that Hebrew verbs are derived from triliteral roots; that is, consist of three letters, as מלך [M L K], which will be a verb or a substantive according to the vowels pronounced with those consonants, thus *malak*, he reigned; *malok*, to reign; *melek*, a king.

The roots of the Shemitic languages then are dissyllabic, yet many are monosyllabic as דם (*dam*), blood. Their vocabularies are essentially the same, especially for primitive words, which constitute the original materials of speech expressive of simple and primitive ideas, such as 1st. Words denoting persons and family relations; 2d. Names of the principal elements of nature and the visible objects of the universe; 3d. Names of common animals; 4th. The numerals or names of numbers; and 5th. The pronouns. Verbs also denoting common actions and states are essentially the same, as to eat, drink, seek, find, live, die, kill, walk, remember, see, hear, &c. It would occupy too much space to cite examples from these classes of words in illustration of the sameness of the vocables of these languages, but the great fact of the sameness can only be explained by their descent from a common source. That source has been supposed to be one of the languages—the

Hebrew, but the prevailing opinion is, that the Hebrew as well as the others are descended from an ancestral language which has long been extinct, and lives only in its descendants.

The grammar of these languages is also essentially the same. The Arabic is rich in grammatical forms, but the Assyrian is far richer, and was happily termed by Dr. Hincks, the Sanskrit of the Shemitic languages. The case-endings of nouns—*u* (nominative), *i* (genitive), and *a* (accusative)—of the primitive Shemitic language exist only in Assyrian and Arabic, although relics of them are found in Hebrew and Æthiopic, but they have disappeared from modern Arabic.

Personal pronouns belong both to the lexicon and grammar. They cannot be derived from verbs, or from substantives. They are ancient elements of the earliest stratum of language, and hence their value to the philologist in tracing the genealogy of languages. The personal pronouns in the principal Shemitic languages are as under:—

PERSONAL PRONOUNS—SINGULAR.

First Person, I, is of Common Gender.

Hebrew,	Anoki and Ani.
Chaldee,	Anah and Ana.
Syriac,	Ano.
Arabic,	Ana.
Assyrian,	Anaku.

Second Person, THOU, Masculine and Feminine.

Hebrew,	*masc.*	Attah, for Antah;	*fem.*	At.
Chaldee,	,,	Antah·	,,	Ant.
Syriac,	,,	Ant;	,,	Anti.
Arabic,	,,	Anta;	,,	Anti.
Assyrian,	,,	Atta;	,,	Atti.

Third Person, HE and SHE.

Hebrew,	*masc.*	Hu;	*fem.*	Hi.
Chaldee,	,,	Hu;	,,	Hi.
Syriac,	,,	Hu;	,,	Hi.
Arabic,	,,	Huwa;	,,	Hiya.
Assyrian,	,,	Su;	,,	Si.

PERSONAL PRONOUNS—PLURAL.

First Person, WE, is of Common Gender.

Hebrew,	Anachnu (nachnu, anu).
Chaldee,	Anachna (nachna).
Syriac,	Chnan.
Arabic,	Nachnu.
Assyrian,	Ni (?).

Second Person, YE, Masculine and Feminine.

Hebrew,	*masc.*	Attem, for Antem;	*fem.*	Atten, for Anten.
Chaldee,	,,	Antun;	,,	Antin.
Syriac,	,,	Antun;	,,	Antin.
Arabic,	,,	Antum;	,,	Antun.
Assyrian,	,,	Attunu, for Antunu;	,,	Attina, for Antina.

Third Person, THEY, Masculine and Feminine.

Hebrew,	*masc.*	Hem;	*fem.*	Hen.
Chaldee,	,,	Himmon;	,,	Hinnen.
Syriac,	,,	Henun;	,,	Henen.
Arabic,	,,	Hum;	,,	Hun.
Assyrian,	,,	Sunu;	,,	Sina.

The likeness of the personal pronouns in these languages is better displayed when written in their own letters than by means of transliteration into Roman letters. It will be observed that the Assyrian pronouns of the third person singular and plural begin with *s*, while those of the other languages begin with *h*. In other words an Assyrian *s* corresponds to a Hebrew *h*: and Aryan philologists know of such correspondence in the Sanskrit and Zend, as well as in some of the Celtic languages.

Fragments of the personal pronouns are suffixed to substantives to express the genitive, and then serve as possessive pronouns. When suffixed to verbs, they express the accusative. When suffixed to particles, they express the genitive, when the particle includes the meaning of a substantive, but the accusative when it includes the meaning of a verb. This is common to the Shemitic languages, and it is unnecessary to occupy space by quoting a series of words which would present a likeness as close as that between the separate pronouns.

The conjugation of verbs is effected by the addition either as prefixes or affixes, and in some cases both, of fragments of the personal pronouns to the ground-form of the verb. The Hebrew has seven of these ground-forms in common use, and others of less frequent use. In the Chaldee, Syriac, and Arabic languages a considerable number of forms occur, which are not found in the common grammars of those languages; thus Erpenius gives thirteen forms of the Arabic triliteral verb, M. de Sacy fifteen, Scheidius upwards of forty, and Mr. Lumsden fifty.

The following table exhibits the simple ground-form of the tense with prefixed fragments of pronouns of the verb *Paqod* to visit, in the Hebrew, Assyrian, Chaldee, Syriac, and Arabic languages. The numerals denote the persons of the tense, and the letters C, M, and F denote the genders to be common, masculine, and feminine respectively:—

PAQOD, to Visit.

	Hebrew.	Assyrian.	Chaldee.	Syriac.	Arabic.
	Singular.				
1. C.	efqod	apqid	epqud.	epqud	apqud.
2. M.	tipqod	tapqid	tipqud	tepqud	tapqud.
F.	tipq'di	tapqidi	tipq'din	tepq'din	tapqudi.
3. M.	ipqod	ipqid	ipqud	*nepqud	yapqud.
F.	tipqod	tapqid	tipqud	tepqud	tapqud.
	Plural.				
1. C.	nipqod.	napqid	nipqud	nepqud	napqud.
2. M.	tipq'du	tapqidu	tipq'dun	tepq'dun	tapqudu.
F.	tipqodnah	tapqida	tipq'dan	tepq'don	tapqudna.
3. M.	ipq'du	ipqidu	ipq'dun	*nepq'dun	yapqudu.
F.	*tipqodnah	ipqida	ipq'dan	*nepq'don	yapqudna.

The comma placed between two consonants in the Hebrew and Chaldee columns represents the movable shwa under the letter preceding it. And the comma so placed in the Syriac column represents an inserted sound, unwritten, but to be heard sufficiently to facilitate the pronunciation of the word. The movable shwa of the Hebrew and Chaldee, and the unwritten Syriac, are short vowel sounds, and may be pronounced as the *e* of the word her, but so short as not to constitute a syllable.

It will be observed that an asterisk is placed in the Hebrew column, and three in the Syriac, in order to mark irregular forms, which cannot be accounted for, and which are deemed to be corruptions of the ancient and true forms.

The Indo-European and the Shemite languages have been profoundly studied. They are well marked, and the members recognized as belonging to each fall into their proper places in the group. These two families of languages, however, contain but a very few out of the large number that exist on the earth, and of that large number very few have been studied; yet some philologists group all remaining languages together under the general name Turanian. It would be far better to term them Unplaced, and to leave the term Turanian to designate the Scythic languages of High Asia, to which it was first applied. In South India is a group of allied languages, comprising the Tamil, Telugu, Canarese, Malayalam, &c., which are sometimes named the Tamulian languages, but which Mr. Caldwell, in his excellent Comparative Grammar of them, terms the Dravidian languages. The word Dravida in Sanskrit means an outcast, and Dravidas is the country of the outcasts, which was applied by the Sanskrit geographers to the Tamil country. This Dravidian family of languages is not connected with the Indo-European nor with the Shemitic, but appears to be allied to the Scythic tongues of Northern

Asia, and some philologists believe especially with the Finn class of tongues. Our space will not allow of even a sketch of the different groups of languages which cover the earth, nor is it necessary for the objects contemplated in this article. We have described and illustrated in a brief manner the Indo-European family of languages, and have lightly sketched the Shemitic family. We have now to offer a few remarks on these two groups.

Philological researches have shown broad and trenchant lines between those two groups. The object now is to compare the ancestral languages of those groups. How can this comparison be made? The oldest members of the Indo-European family are sisters descended from one mother. The same may be said of the members of the Shemitic family. In treating of the Indo-European vocabularies we drew attention to the words that are common to them, but said nothing concerning those words which belong only to two or three of the group, and for which the other members have a different word—thus, Gē, the earth, is found only in the Greek, the Sanskrit being Dhara, the Latin, Celtic, and Gothic being variant forms of Dhara. Where did the word Gē come from? Did it descend from the ancestral language, or was it imported? The same question may be asked of many other words, not only in Greek, but in each of the other languages of the family. There is abundant evidence that some of these solitary words have been imported, but as regards other words there are valid reasons to consider them of native origin. Some languages of the family have duplicate words for the same thing; thus, the Sanskrit has two words for the sun, namely, Hailih and Sunus. The Greek Hēlios, Welsh Haul, Latin Sol, Slavonic Solnze, Lithuanian Saule, Gothic Saūl, Irish Saule, are variant forms of the former word; while the Gothic duplicate Sunna, which alone is retained in all the other Teutonic dialects except the Scandinavian, is a variant form of the latter word. Both words must have been in the vocabulary of the ancestral language of the Indo-European family. In attempting to institute a comparison between the ancestral languages of these two families, the vocabularies of each member must be employed; but the words in these vocabularies are variants of the words of the ancestral language, so that a word in the ancestral language is not quite the same form that has come down to us in any of the sister dialects. We do not know its precise form, but we know its form within certain limits, for it must be such a form as could originate all its descended variants.

Sanskrit grammar has been of immense value to the philologist, for it has enabled him to find the element, root, or stem of the words in the vocabularies of the Indo-European languages. These roots are monosyllabic, and commonly consist of a vowel flanked on each side by a consonant, as *log* of the word *logos*. In these languages, then, the word can be stripped of its suffixes and affixes to its crude form, and thence to its root. Every Sanskrit scholar knows how regularly words are built up from the roots in that tongue, and those who have applied the Sanskrit crude form system to Latin and Greek know how much light it throws on the formation of words.

The roots of the Shemitic tongues are not roots in the Indo-European sense of the term, for Hebrew roots, for instance, are actual words. The verbal root is the third person singular masculine of the preterite, which is a dissyllabic word. Now, the question occurs, Cannot this root be analyzed to a true root—one in the Indo-European sense of the term? In short, can it not be reduced to a monosyllable? If the actual roots of the Hebrew can be obtained, we may compare them with the Indo-European, and determine the question of a conjectured affinity between the ancestral tongues of these two families of languages. Researches for the actual roots of the Hebrew language have been made with the view of proving them to be monosyllabic, but as yet without success. The late Dr. Fürst in his Hebrew Lexicon divides the bisyllabic word into two parts, namely, 1st. The organic root; and 2dly. What has become united to it. In some words he finds the organic root to be the first, and in others the second syllable. One result of these researches is to establish the important truth, that the so-called organic root with its united element constituting the word, belongs to the oldest period known of the language, and therefore must have been so united in prehistoric times.

Likenesses between certain Shemitic and Aryan words have been pointed out by many Hebraists, and have their value, but words constructed in imitation of the sounds they express, as the Hebrew *parag*, to break, must not be compared with the Latin *frango*, German *brechen*, and English *break*; for all these may have been so constructed in their several languages. All imported words must also be excluded; but after allowance has been made for such words, there are still many that are partially or wholly alike in the two families of languages. The Irish language was, by some respectable scholars at least, deemed to be allied to the Hebrew, but Dr. Prichard proved the Irish as well as the other Celtic languages to be members of the Aryan family. His proofs are both lexical and grammatical (see his Eastern Origin of the Celtic Nations), which have been confirmed by Pictet and others, and which are accepted by Aryan philologists. A scientific comparison of the two families of languages has yet to be made, which can only be successful when the letter changes of the Shemitic languages shall have been determined.

Dr. Prichard drew special attention to some remarkable likenesses between some Aryan and Shemitic words of the same signification, and added to the list supplied by Gesenius, Lee, and others. The following words are chiefly taken from Dr. Prichard.

The Numerals.

Shemitic family.	Indo-European family.
One, ekhad (Heb.),	Eka (Sanskrit).
Third, tlithay (Chal. Dan. ii. 39),	Tritaya (Sanskrit).
Six, shāsh (Heb.),	Shash (Sanskrit).
Seven, sheva, sheba (Heb.),	Seven, sibun.

Nouns and Verbs.

Hebrew, Yēsh,	He is,	Sanskrit, Asti.
Arabic, Is,		Latin, Est.
		Greek, Esti.
		Teutonic, Is.
		Irish, Is.

Hor, a mountain (Heb.),	Oros.
Leom, people,	Leōs.
Luach, a stone table,	Lhech, a flat stone.
Keran, a horn,	Keras, Cornu.
Naar, a youth,	Narah (Sanskrit), Anēr (Greek).
Naārah, a maiden,	Nari (Sanskrit).
Olem, an age,	Olim (Latin).

The above specimens of likeness do not exhaust the instances, and Dr. Fürst's researches into the Hebrew roots point to many more roots than he has stated to be common to the Aryan and Shemitic families of languages; but the results of his researches require confirmation by investigations of a similar nature for the roots concealed in the words of the other Shemitic languages. The labour of these investigations is very great, and the time required for their completion is long. The labour is one of love, and incapable of a money remuneration, but the collection of evidence to establish truth is a satisfaction, and especially to establish as a truth of science that statement of the inspired writer, which we receive with reverence,—'And the whole earth was of one language and of one speech.'

PHILOMELA, in Greek mythology, a daughter of Pandion, king of Athens, who was transformed into a nightingale. According to the fable Progne, sister of Philomela, married the Thracian prince Tereus, by whom she had a son, Itys. When Itys had grown up Tereus went to Athens, and at the persuasion of his wife took her sister with him on his return. On the way Tereus violated her person, and to conceal his crime cut out her tongue. But Philomela made it known to Progne by means of some tapestry, on which she embroidered her story. To gratify their revenge they murdered Itys, and served him up to his father. When he saw the remains of his son he pursued them; but they invoked the gods for help, and they were all immediately transformed. Progne fled to the woods in the form of a nightingale lamenting for Itys. Philomela mournfully uttered *Tereu* under the form of a swallow, in broken chirpings, on account of the mutilation of her tongue; and Tereus, in the form of a lapwing, uttered a piercing *poo* or *woo*. Another story makes Philomela the wife and the nightingale, and Progne the sister and the swallow.

PHILOPŒMEN, the last great military commander of the Greeks, was born at Megalopolis, in Arcadia, about B.C. 252, and after the early death of his father was educated by Cleander, a noble Mantinæan. Two academical philosophers were his teachers, and instilled into him high principles of honour and patriotism. Disinclined to a life of study, and thirsting for enterprise, military glory was his ambition, and to that all his youthful exercises were directed. No sooner had he begun to bear arms than he joined his countrymen in their incursions into the Spartan territories. When he was thirty years old Cleomenes, king of Sparta, surprised Megalopolis by night, and Philopœmen, who had unsuccessfully endeavoured to repel him, covered the retreat of his fellow-citizens to Messene at the extreme hazard of his own life. In the following year when Antigonus, king of Macedonia, came to the assistance of the Achæans against Cleomenes, Philopœmen joined him with the cavalry of his native place, and distinguished himself in the battle of Sellasia, in which the Spartans were totally defeated. After this he served for some years in the Cretan wars as a volunteer, and, returning thence with a high reputation, he received from the Achæans the command of their cavalry, which under him became formidable throughout all Greece. In a battle with the Ætolians and Eleans he killed with his own hand the commander of the Elean cavalry, and thus decided the victory in his favour. In 208 B.C. he was appointed *strategus* or commander-in-chief of the forces of the Achæan League. After having reorganized the Achæan army he led it into the field against Machanidas, tyrant of Sparta, whose forces he signally defeated, himself slaying Machanidas with his own hand. The Achæans perpetuated the memory of this achievement by the erection of a bronze statue in the temple of Delphi. In 201 he was again elected *strategus* of the league, and defeated Nabis, the successor of Machanidas. He afterwards went to Crete a second time, to take the command of the forces of Gortyna. He returned to Peloponnesus in 194, and two years later was again appointed general of the league, and took the field against Nabis, whom he once more defeated. Nabis was soon afterwards murdered, and Philopœmen induced the Spartans to join the Achæan League; but, soon becoming dissatisfied, they separated from the confederacy, and called in the Romans to their assistance. Philopœmen, as commander of the Achæans, declared war against Sparta, and, having taken the city, treated it with the greatest severity. He commanded the Spartans to destroy their walls, to dismiss their mercenaries, to admit the exiles, to expel the slaves who had been set free by the tyrants, and substitute the Achæan code for the laws of Lycurgus. The Romans, however, interfered, and finally prevailed on the federal congress to admit Sparta again into the confederacy as an independent state. Hardly was this affair settled when Messene revolted. Philopœmen, though broken by infirmity and disease, marched against the insurgents, and at first beat them back; but was afterwards attacked with such fury, that he was obliged to give way, and, falling into the hands of the enemy, was carried in chains to Messene. Here he was cast into a dungeon, and compelled to drink poison. Thus died (B.C. 183) one of the greatest generals of Greece, whom the ancients compared to Hannibal and Scipio. The news of his death filled the whole of Peloponnesus with grief. His ashes were transported to his native city with great pomp, Polybius, the historian, carrying the urn; statues were raised to his memory in most of the Grecian cities, and a yearly offering was made at his tomb by the city of Megalopolis.

PHILOSOPHER'S STONE. See ALCHYMY.

PHILOSOPHY (Greek, *philosophia*, love of wisdom) is a term which was first brought into general use by Socrates, who employed it to denote the science that deals with the causes and existence of things. The origin of the term itself is attributed, though on doubtful authority, to Pythagoras, who modestly styled himself *philosophos*, lover of wisdom, in contradistinction to the more pretentious title of *sophos*, the wise, arrogated to themselves by some of his predecessors. Philosophy is a science; but, unlike other sciences, it is not conversant about any special range of phenomena with their approximate causes, but deals rather with the general principles which form the basis of these sciences, and of which they themselves take no cognizance. It follows up the *data* of experience to their ultimate grounds, regarding each particular fact in relation only to a final principle, and as a determinate link in the system of knowledge. In this view philosophy may be defined as the science of principles. It can never, however, be regarded as a completed science so long as man is in a state of development, for it must always wait upon the laws of this development. The progress of the science will be best seen in its history, which presents us with a series of philosophical systems exhibiting thought in its various stages of development. Accordingly in what follows we shall endeavour to trace a brief outline of the history of philosophy.

The history of philosophy is the relation of the most important attempts to realize the ideas of philosophy, or, according to Tennemann, the pragmatical representation of the gradual development of philosophy as a science. It is of great value as one of the most important branches of the history of human civilization, and presents the most important problems of philosophy in their true meaning, extent, and connection, illustrates the various philosophical systems, and affords a survey of the progress and aberrations of the human mind which teaches the most instructive lessons. The history of philosophy is commonly divided into the ancient, middle, and modern. Some divide it into the Greek (including the Greek philosophy in the Roman Empire) and the modern European. In this division the philosophy of the middle ages forms, as is obvious, the transition. The first period begins with the Greek, because, though the disposition to philosophize is confined to no particular nation, but is inherent in all, so that every tribe forms philosophical notions as soon as its religious conceptions pass over into reflection, and its feelings into doubt, yet philosophy was first studied scientifically by the Greeks.

Among his non-Mosaic works are a Treatise de Mundi Incorruptibilitate, and De Vita Contemplativa and Quod Omnis Probus Liber, which treats of the Essenes.

Before the time of Philo the hellenized Jews (see HELLENISTS), particularly those of Alexandria, had begun to blend the ideas of the Greek philosophers with the teaching of their own sacred books; but as they generally held that the Pentateuch itself was the source of inspiration from which the Greeks derived what was true in their philosophy, they did not borrow directly from them, but arrived at similar conclusions by allegorical interpretations of their own books, and even by the invention of spurious ones. It was in this Alexandrian school of hellenized Judaism that Philo was brought up. He did not even know the Hebrew Scriptures except through the Septuagint version. His philosophy was thus strictly a theosophy. It rested, as its direct foundation, on the Jewish Scriptures as an inspired revelation, and with these it incorporated the speculations of the writer, founded on the systems of Greek philosophy which best harmonized with the teaching of the Hebrew Scriptures, as Plato and Aristotle, in the form of comments on and deductions from the sacred text. There is neither much depth of original speculation nor much logical consistency or scientific completeness of system in Philo. On the other hand, he was not deficient in constructive power, and his works form the best representative of the Græco-Jewish philosophy.

Philo's idea of God was partly religious, partly philosophical. From his faith as a Jew he derived the principle that God is to be worshipped as a personal being, but in developing his conception of God he is indebted chiefly to philosophical speculations. He held that God is incorporeal and only cognizable by reason. He is the most universal of beings, and higher than knowledge, goodness, or beauty, *per se*. He has, strictly speaking, no attributes, being pure, unqualified being: he is therefore incomprehensible. The attributes ascribed to God in Scripture are to be understood only figuratively. God is present everywhere in the material universe by his operations; nowhere in his essence. God is the only free being. All others are subject to necessity. Philo's notions of matter are not remarkably consistent. He held God to be too perfect to have any association with it, yet he holds him to be the Creator of the universe. Matter, which has only an apparent existence, is the cause of all evil, as opposing resistance to the arrangements of the Creator. In its primeval state it is passive, lifeless, and destitute of quality or form. Between God and the world there is an intermediate being, the Logos. Philo wavers in his account of the Logos also. The Logos is the most universal of all beings except God. Philo personifies the Logos, but not so consistently as to render it certain that a distinct person and not a mere emanation or assemblage of attributes is intended. Thus he represents God as the source of light, the Logos as the nearest circle of light proceeding from it, and each separate power as a separate ray. The Logos contains in itself the sum of ideas—powers or spiritual forms which pervade the universe, and which are creative, governing, foreseeing, law giving, &c. These forms are also regarded as either qualities of the deity or distinct persons. Sophia, wisdom, is sometimes considered as the first of the potencies of the Logos, sometimes as the mother of the Logos. God created the world, as already indicated, by the agencies of these potencies, or of the Logos in whom they reside, out of unqualified matter. He gives the Logos the titles of Son of God, Paraclete, and Mediator between God and Man. Philo added an element of mysticism to his Platonic speculations. He held logic and physics to be inferior to metaphysics as a mental discipline, and the highest attainment of philosophy to be the intuition of God, which is attained through divine illumination by means of self-renunciation and the resignation of finite consciousness to the divine influence.

In interpreting Scripture Philo recognizes a double sense, the allegorical, which is the higher and more important, and the literal, which is not to be neglected. The anthropomorphic representations of God in Scripture he regarded as an accommodation to the sensual nature of man. Even in history the allegorical sense is never wanting; thus he divided the laws into unwritten laws, which are contained in living patterns, as Abraham, Isaac, Jacob, Moses, &c., and written laws, which are contained in particular precepts. It is a fundamental principle with him that the law, which emanates from the Being who is both the creator and the father of the universe, is in harmony with nature, and that he who violates it is punished by natural events. He who lives according to the law of Moses is a citizen of the world. He defended the outward observances of religion against those who would have reduced them to mere symbols. 'Although circumcision,' he said, 'properly symbolizes the removal of all passion and sensuality and impious thoughts, yet we may not therefore set aside the practice enjoined; for in that case we should be obliged to give up the public worship of God in the temple, and a thousand other necessary solemnities.'

The whole of Philo's works are not extant. Some treatises have been recovered by Angelo Mai and Baptist Aucher in palimpsests. Critics differ as to the arrangement of his Mosaic commentaries, and as to the fact of their having been originally continuous. Philo's works have been edited by Thomas Mangey (London, 1742), A. P. Pfeiffer (Erlangen, 1785–92; second edition, 1820), C. E. Richter (Leipzig, 1828–30). A stereotyped edition was published at Leipzig, 1851–53; and there are several editions of particular treatises. J. G. Müller, August Gfrörer, A. F. Dahne, Grossman, H. Planck, and numerous other scholars, have written on Philo.

PHILOLOGY. This word is the English form of the Greek *philologia*, and it formerly carried the same extensive signification; but it is now adopted to signify the science of language. It is difficult to define the signification of *philologia*, for it appears only to have been used in a vague sense to comprise all literature and some science. Thus grammar, rhetoric, logic, criticism, poetry, oratory, biography, and history, have all been included under the term. And all science that was not philosophy, in the Greek sense of that term—all, indeed, that could not be comprised within the limits of philosophy, was embraced under the general term of philology; so that philology became a refuge for all that philosophy excluded, rather than a defined division of general knowledge. It will be seen that the subjects comprised under the term philology were not united by any bond of common characteristics, but by the sole circumstance that they were not philosophy. They might be highly philosophical, as the masterly treatises of Aristotle on logic and rhetoric have universally been deemed to be; but if they were not philosophy they were thrown beyond its boundary, to find a refuge under the general term of philology. A person skilled in philology was called *philologos*, a term which corresponds to our philologist, philologian, or philologer, only these terms, in modern times, have shared in the limitation of meaning which, as already remarked, the word philology has undergone.

The Romans adopted much from the Greeks. Cicero admired and deeply studied the Greek language, philosophy, and literature. He did much to

make Greek learning fashionable in Rome. Cicero divided his writings into two classes; the orations constituted one class, and all his other works the other, which he denominated philological. Several of his treatises, as that on the nature of the gods, are philosophical, but he wrote nothing on philosophy itself; so that his classification is after the Greek model; yet he felt that his orations were not philology, and he placed them by themselves, apart from both philosophy and philology.

After the revival of letters the learned men of Europe adopted the terms and distinctions of Greek philosophy and literature; and some adopted the term *philologus*, which is found under the engraved portraits of distinguished scholars of the period. The reader will observe, however, that the learned men of Europe adopted the word *philologus* in a different sense from what the word signified in Greece and in Rome. In Greece the term was applied to a man who was learned in the grammar, criticism, and literature of his mother-tongue. It was the same in Rome. But in Europe all the learning in his mother-tongue would count for nothing; he must be learned in two foreign languages in order to be deemed a *philologus*. The Greeks called all languages but their own barbarous. So did the Romans. The learned men of Europe, with strange inconsistency, agreed with both the Greeks and the Romans to stigmatize all other languages as barbarous, and, by way of contrast, both were termed learned languages. No doubt nearly all secular learning at the revival of letters was contained in the Greek and Latin languages; but, as Mr. Cobbett acutely remarked, that circumstance does not make the languages learned.

The subjects comprised under the term philology have each been so studied, developed, and expanded by modern inquiry as to become great centres of knowledge. Thus the antiquarian studies other antiquities, writings, numismatics, chronology, and history than those of Greece and Rome. The growth of these several subjects into large dimensions, and their characteristics being so different from what they were when limited to the things of Greece and Rome, have together led to the disuse of the term philology in its old sense; and the study of languages having assumed a character and importance which it never before possessed, the new science—for such the philosophy of language is—has received the name of philology. This term, however, has not yet obtained undisputed title to name the new science, for others are also adopted. Sir John Stoddart proposed the terms glossology and glossography; but as these could name only the lexical, to the exclusion of the grammatical part, they have not been received. The terms linguistic science and linguistics, although not much in use in Great Britain, are frequently heard on the Continent. The objection to the terms is, that a man who is able to read and write several languages is designated a linguist. Now a man may be a good linguist, and yet care nothing to know the philosophy and genealogy of languages. He may be able to read and write a number of different languages, but yet have no interest in tracing the relationship of one language to another, or in speculations on the origin of language. The term linguist, then, already appropriated to a man who is skilled in languages, leaves the term philologist as a designation for him who studies languages in order to trace their relationships and genealogies, and the allied word philology is the name for the science. The establishment in London, in 1844, of a society for the advancement of philological science, and named by the founders the Philological Society, and the convenience of having the science named by one word, and that a substantive, will probably induce the learned to agree in recognizing the term philology as the name of the science whose aim is to develop the philosophy of language.

Philology has a wide scope; for it aims at describing all the languages now spoken on the earth—at determining their affinities and relationships to each other—at tracing the antecedent languages of each living speech up to its first ancestral language—at determining the affinities and relationships of those antecedent and ancestral languages to each other—to make out the genealogy of each, and thus to arrive at a knowledge of the natural history of language. The philologist feels as much interest in classifying languages into family groups as the zoologist does in classifying animals into family groups. But however great may be the interest which attaches to a knowledge of languages, the philologist feels that such knowledge has a greater interest and a higher value when applied as a means to an end—as a means to solve important questions in philosophy, in history, and in ethnology.

The history of philology is like that of other sciences—its origin, a few facts obtained by empirical observation, which were slowly augmented by others gained in a similar manner, and the whole remaining a crude undigested mass for a long time before appropriate ideas were brought to bear upon them to bring them into shape. But as soon as these ideas were applied the empirical facts were verified and reviewed with a purpose, the signification of the facts was understood, and similar facts were sought after in other languages. The facts brought to light by these researches were examined in relation to those previously known, and all in relation to the ideas that were supplied by the philologist. The facts were analyzed and classified, new principles were seen, laws were discovered, and the accumulated knowledge gradually assumed the characters of a classificatory science. As the space assigned to the article PHILOLOGY does not allow room to fill in this sketch with the historical details, we shall refer to a few authorities to enable the reader to collect them for himself. In the Restitution of Decayed Intelligence in Antiquities, by Richard Verstegan (1605), the reader will find profound views on the value of philology in determining questions of history and ethnology. Verstegan was a Teutonic scholar of a large range of languages, comprising the living Scandinavian tongues. He was anxious to compare the German and Persian languages, in order to determine the question then mooted of the Persian origin of the Germans. He took great pains to obtain a Persian vocabulary for the purpose, and at last depended on a comparison made for him by a friend in Italy in 1601. On that information, although he found certain words to be alike, he decided that the German is not descended from the Persian. He considered the Persian to be no more connected with the Latin, although certain words are common to those tongues, than the Latin and Welsh, and 'broken Latin words' are found in the Welsh language. He says he has heard that Hebrew words are found in the Irish language, but not enough to make the Irish to be 'good Hebricians.' His comparison of the English and Dutch languages, in order to exhibit a 'nearness of speech,' and his comparison of the Persian and Latin by means of the first five verses of the first chapter of Genesis, in order to exhibit a 'farness of speech,' are specimens of lingual comparison made in the earliest period of the history of philology. Verstegan was a traveller, and obtained his knowledge of the languages by residence in the countries in which they are spoken. He was not a mere linguist. He maintained that England was originally connected with France by continuous land from Boulogne to Dover, and his arguments

successor, however, of Descartes was Spinoza. The scheme of Spinoza reduces the three Cartesian substances to unity, to one infinite original substance, the ground of all things, that excludes from itself all negation or determination, and is named God or nature. To this belong an infinite number of attributes, of which two only are known to us, thought and extension. Modes are the changing forms of these attributes. To regard finite things as distinct individualities is the mistake of our imagination; the reason contemplates them only as *natura naturata*, in which the *natura naturans* is revealed. Spinoza's is the most elaborate of all systems of pantheism. Locke (1632–1704), who had a precursor in Hobbes (1588–1679), the influence of whom, however, chiefly concerned the history of political science, is regarded as the father of modern materialism and empiricism. Two leading thoughts run through his philosophy: first, that there are no innate ideas, as Descartes had maintained; and second, that all our knowledge springs from experience. The mind is a mere mirror of the external world, a dark room into which the images of external objects enter, without any contribution being furnished on its part; its entire contents are due to impressions made on it by material things. Locke, however, did not always remain true to his principles, and it remained for his successors to carry them to their ultimate conclusions. As occupying the general position of Locke mention may be made of the names of the illustrious Isaac Newton (1642–1727); Samuel Clarke, a disciple of Newton's, principally interested in moral philosophy (1675–1729); and the English moralists of the period, William Wollaston, the Earl of Shaftesbury, and Francis Hutcheson. The philosophy of Locke received a further development in France. There Condillac sought to explain the development of humanity by the simple development of the sensations. Others went further and reduced sensation itself to a purely physical phenomenon. Then followed the materialism of Helvetius, d'Holbach, La Mettrie, and others, including several of the Encyclopedists, though neither Voltaire, Diderot, nor d'Alembert belonged properly to the school of materialists. The result of this philosophizing was to make the material world the only form of existence, mind only a collection of atoms, the basis of its action egotism, and the end of these actions a refined sensuality. The belief in moral freedom, virtue, God, providence, and immortality were thence regarded as folly unworthy of a reflecting mind. In opposition to the materialism we have been considering there arose the system of idealism. Just as the former seeks to materialize mind, so the latter seeks to spiritualize matter. The one holds that there are only material things, and the other, as represented by Leibnitz and Berkeley, that there are only spirits and the thoughts of spirits—ideas. Every substance, according to Leibnitz (1646–1716), possesses an activity of which we can only gain an idea by comparing it to the activity of our mind, and which he denominates perception, as causing us to know, and appetition, as causing us to will. The universe is an aggregate of intelligent, self-active, immaterial points, which he calls monads, and which combine as elements to form everything. Each monad has a nature peculiar to itself, and cannot be acted upon by anything external to itself. The soul, which is a conscious monad, cannot therefore act upon the body, and the relation between them is due to a pre-established harmony, God having so constituted them in the beginning that they operate in perfect harmony, though independently. God is the sufficient cause of the universe, and the world is the best of all possible worlds. The theories of Leibnitz were systematized by Wolff, and from his time to Kant German philosophy assumed no new stand-point. Berkeley (1684–1753), founding on Locke's principle that we are percipient of nothing but our own perceptions and ideas, and that all the objects of human knowledge are ideas of sensation or reflection existing in the mind itself, comes to the conclusion that the existence of bodies out of a mind perceiving them is impossible, and a contradiction in terms. Granting the premises of Berkeley, which were the commonly received philosophical views, at least in England, his conclusions could not be refuted; but it was reserved for Hume to trace out, by a vigorous and unshrinking logic, the legitimate consequences of the Cartesian and Lockian philosophy to their ultimate results, and thus, though unintentionally, by a sort of *reductio ad absurdum*, to produce the great metaphysical revolution of which Reid and Kant were the first movers.

From the data of Locke Hume deduced the negation of all causality, all notions expressive of a relation of necessity being merely the result of an association of ideas. The ego or self is nothing more than a bundle of ideas: it is quite illusory to suppose a substratum called the soul underneath these ideas. The scepticism that follows from premises like these may be easily inferred. Properly speaking, it ends in *Nihilism*, God, mind, and matter being alike denied. The attempt to oppose the scepticism of Hume gave birth to the Scottish or 'common sense' school of philosophy. This school, modest and perhaps timid in its pretensions, has the merit of having first strongly and largely inculcated the absolute necessity of admitting certain principles as the foundation of all reasoning, and the indispensable conditions of thought itself. According to the Scotch philosophers certain simple ideas are implied and involved in certain intuitive judgments of the mind; thus identity, cause, time, number, truth, certainty, probability, are ideas peculiar to a rational mind, and necessarily arise in the human understanding when employed in the exercise of its different faculties. Reid, therefore, while he rejected the Cartesian theory of ideas or images in the mind being the only objects of thought, directed his inquiries to an analysis of the various powers and principles of our constitution, in order to discover the fundamental laws of belief which form the groundwork of human knowledge. Though professing to build only on experience he did not limit experience to the relations of sense and its objects. Without claiming for man more than a relative knowledge of existence, and restricting the science of mind to an observation of the fact of consciousness, he analyzed that fact into a greater number of more important elements than had been recognized in the sensualist school. He showed that phenomena are revealed in thought which cannot be resolved into any modification of sense; that intelligence supposes principles which, as the conditions of its activity, cannot be the result of its operations; and that the mind contains notions which, as primitive, necessary, and universal, are not to be explained as generalizations from the contingent and particular, about which alone our external experience is conversant. Dugald Stewart, with some deviations, followed in the track of his master; but Thomas Brown, while he adopted not a few of the principles of Reid, departed on many points of fundamental importance from his philosophy. The same occasion that give rise to the Scottish school—namely, the sceptical conclusions of Hume and others—also produced the philosophy of Emmanuel Kant. Kant (1724–1804), who may be justly regarded as the father of the philosophy of the nineteenth century, sought to bring together into unity the one-sided endeavours of his predecessors in the realistic and idealistic schools. He took up a critical

stand-point, and from it instituted an inquiry into the origin of our experience or cognition. All cognition is the product of two factors—the knowing subject and the objects known. The one factor, the external object, contributes the material of knowledge; the other factor, the subject, contributes the form, or those notions in virtue of which alone any connected knowledge is possible. If the external world had no existence we would have no perceptions, and if we possessed no *a priori* notions our perceptions could not be combined so as to form an understood whole. Though cognition (knowledge) is the union of these two elements, yet we do not know things as they are in themselves, partly because of the forms native to the mind (categories, of which he enumerates twelve), which are necessarily productive of some change in the objects; and partly because our perceptions themselves are modified in their transit through the subjective mediums of time and space, which are the universal forms of all objects of sense: whatever is to be perceived must be perceived in time and space. In his practical philosophy he seeks to show that consciousness reveals to us the autonomy of the will, expressing itself in the supremacy of conscience, which is the categorical imperative of duty. This moral nature implies freedom as its necessary condition; the existence of God, as otherwise there would be a law without a law-giver or judge; and the immortality of the soul for the completion of our moral existence. These truths, the postulates of the practical reason, lie beyond the bounds of actual science, but are the undemonstrable necessities of a rational faith. The ablest opponent of the Kantian philosophy, Jacobi, took the stand-point of faith in opposition to that of criticism, in order to give theoretic certainty to the postulates of the practical reason. The absolute, which is unattainable by the reason, may be grasped by feeling, which gives immediate knowledge requiring no other evidence. In his later writings he identified faith or intuition with the Kantian reason, claiming for the latter the faculty of objective knowledge. In the hands of Fichte, who was the direct successor of Kant, philosophy was made to assume a purely idealistic aspect. The critical idealism of Kant becomes absolutely subjective idealism. 'All that is, is ego;' this is the principle of the Fichtian system. The world is not only phenomenal, but is a hypothesis of the absolute ego. 'We know nothing,' says he, 'but by consciousness; consciousness is but a phenomenon; the images present to us are formed of images and by images; all reality is changed into a wondrous dream, without a life to dream of and without a mind to dream, a dream composed of a dream of itself. Perception is a dream; thought is the dream of that dream.' Fichte's subjective idealism found its continuation in the objective idealism of Schelling and the absolute idealism of Hegel. Schelling (1775–1854) started from the ego of Fichte, and by a combination of the doctrine of the ego with Spinozism transformed it into the system of identity. Object and subject, real and ideal, nature and spirit, are identical in the absolute, and this identity we perceive by intellectual intuition. In nature, which is the negative pole of being, there resides a vital principle—the soul of the world—which unites all organic and inorganic in one complete organism. In the development of spirit, which is the positive or ideal pole of being, there are three stages, theory, practice, and art, or the reduction of matter to form, the introduction of form into matter, and the absolute interpenetration of form and matter. Schelling subsequently, by successively incorporating into his system various opinions from Bruno, Böhme, and others, developed a syncretistic doctrine which constantly approximated to mysticism, and exercised far less influence on the development of philosophy than the original system of identity. Hegel (1770–1831), developing this principle of identity, created the system of absolute idealism. In his philosophy he aims at elevating consciousness to the stand-point of absolute knowledge, and systematically developing the entire contents of this knowledge by means of the dialectical method. The principal stages in the development of human consciousness, from the stage of direct, unreflecting, unquestioning certainty, through the different forms of reflection and self-alienation up to absolute cognition, are consciousness, self-consciousness, reason, ethical spirit, religion, and absolute knowledge, the object of which is the movement of spirit itself. Absolute knowledge recognizes thought and being as identical. Finite things have the ground of their being not in themselves, but in the universal divine Idea. The absolute reason is revealed in nature and spirit: it alienates, externalizes itself in nature, and returns from this its self-estrangement in spirit. Spirit is the idea having emancipated itself from nature, and waked to consciousness in man; and it is by this awaking that the universe as such is produced, since thought and existence are identical. The perfection of spirit is in revealed religion or absolute philosophy, in which the conscious idea attains to universality, and reproduces from itself the whole natural and intellectual universe. Schleiermacher (1768–1834) modified the Kantian philosophy, attempting to do equal justice to the realistic and idealistic elements contained in it. The totality of all existing things is the universe; the unity of the universe is the Deity, with reference to whom man has a feeling of absolute dependence. In this feeling religion has its root. In place of Kant's too narrow conception of duty, by which the specific and variable are sacrificed to the universal, he substitutes the doctrine that each man's duty varies according to his individuality. In the highest good, which he defines as the supreme unity of the real and the ideal, Schleiermacher finds the ethical end of man, in duty the law of advancement towards this end, and in virtue the moving force. Schopenhauer (1788–1860) developed a doctrine which may be described as a transitional form from the idealism of Kant to the realism at present prevalent. In opposition to Fichte's subjective idealism, and to Schelling's renewed Spinozism, Herbart (1776–1841), on the basis of the realistic element in the Kantian philosophy, as also of Eleatic, Platonic, and Leibnitzian doctrines, developed a philosophical doctrine, which he himself denominated realism, from its predominant character. After the death of Hegel, amongst others, Feuerbach, Richter, Strauss (died 1874), Bruno, Bauer, and Arnold Ruge developed, in an extreme manner, Hegelian thought. Beneke (1798–1854), in opposition to Hegel and to Herbart, developed, on the basis of certain doctrines of English and Scotch philosophers, a psychologico-philosophical doctrine, resting exclusively on internal experience. During the last decade in Germany Hegelianism has counted more adherents than any other system. Next to it has stood the Herbartian school; and more recently the modification of systems through a return to Aristotle or Kant, and the study of philosophy upon its historic side, have occupied the larger number of minds. The teachings of Schopenhauer and Beneke, as also of Krause, Baader, Günther, and others, have been reproduced and modified by individual disciples. Materialism is represented by Vogt, Moleschott, and Büchner, and sensualism in Czolbe and others. While resting in part upon the basis of the doctrines of earlier thinkers, Trendelenburg, Fechner, Lotze, and others have advanced in new and peculiar paths. The doctrines of H. Ritter,

Carus, Weisse, the younger Fichte, and others also merit attention.

Though philosophy of late years has nowhere been cultivated to such an extent as in Germany, other countries have made no inconsiderable contributions to philosophical science. In France two philosophical tendencies opposed the sensualism and materialism so universal at the beginning of the century. Of these the one was theosophical and the other found expression in the eclectic and spiritualistic school which was founded by Royer-Collard as the disciple of Reid, which was further built up by Cousin, who incorporated into its body of doctrines a number of German philosophemes, and in which the Cartesian tradition was renewed. Less brilliant than Cousin, but possessing no small merit as a thinker, Jouffroy attempted to unite the philosophy of his predecessor Maine de Biran to that of the Scottish school, and became associated with the spiritualistic school, to which also belong the names of Garnier, Janet, Rémusat, Franck, Jules Simon, and others. This school has contended valiantly against the pantheistic tendencies of the age. Independent systems are those of Pierre Leroux, Lamennais, Jean Reynaud, and Buchez. Materialism has its supporters in Cabanis, who sees in thought only a secretion of the brain, Broussais, Gall, and others. Positivism, founded by Auguste Comte, numbers not a few followers, at the head of whom is Littré. The chiefs of another school, founded on the basis of Kantian criticism, are Renouvier and Pillon.

In Great Britain the Scottish school had later exponents in Sir James Mackintosh (1765–1832) and Sir William Hamilton (1788–1856), the last-named being, moreover, largely influenced in some points of his psychology by Kant. Our knowledge, according to Hamilton, is conditioned by our faculties; we have no faculty for comprehending the infinite and absolute; and all human philosophy, therefore, treats only of the relative and phenomenal. The absolute, as unknowable, is transferred from the province of philosophy to that of religion, from reason to faith. Mansel may be mentioned as a disciple of Hamilton. Ferrier (1808–64) assumed a polemical attitude towards the common-sense school in respect of its fundamental peculiarity, as he viewed it, of absorbing philosophy into psychology as well as on minor details of the system. The associational psychology of Hartley, Priestley, and Dr. Darwin has its representatives in the nineteenth century in James Mill (1773–1836) and his son John Stuart Mill (1806–73), who make the principle of association the sole explanation of psychical phenomena. Bain, Grote, and Lewes follow more or less in the same track. Herbert Spencer has attempted to widen the psychological principles of the associational psychology into a universal doctrine of evolution, which should not only provide for the evolution of all forms of being but also of the fundamental principles of philosophy itself. In America, as in England, philosophy has been prosecuted more as an applied science, and in its special relations to morals, politics, and theology. Speculation there has been widely influenced by Scottish philosophy. Among the best known names of transatlantic philosophical writers are those of Jonathan Edwards, Henry P. Tappan, Thomas C. Upham, Francis Wayland, and others. A modified scholasticism, mostly Thomism, prevails in the Catholic seminaries of France, Spain, and Italy. In most of the continental countries German philosophy has exerted no small influence. In Italy a peculiar philosophical school, represented by Rosmini, Mamiani, and Gioberti, has flourished during the present century. Gioberti and Rosmini have been characterized as the Plato and Aristotle of modern Italy. The former developed a philosophy that was designed to reconstruct all modern science and society. He starts with the intuition of real being, of the active Deity, as the absolute source of existence. Philosophy is founded on revelation and perpetuated by the church, which is the depository of truth and source of civilization. According to Rosmini philosophy is the science of the ultimate reasons; the product of highest reflection, it is the basis of all sciences in the universal sphere of the knowable, embracing ideality, reality, and morality, the three forms under which being manifests itself. Mamiani advanced the doctrine that immediate perception is the only foundation of the knowledge of reality. The Italian school is remarkable for its *à priori* method and its respect for ecclesiastical and national tradition. For the Italian philosophers of the middle ages see ITALY, division Italian Literature.

More information regarding the history of philosophy will be found scattered throughout this work in the biographical notices of individual philosophers as well as in the sketches of the different schools of philosophy. For a complete history of philosophy reference may be made to the following works:—Tennemann, Geschichte der Philosophie (eleven vols. Leipzig, 1798–1819), of which there is an abridged English translation by T. R. Morell, London, 1852; Hegel, Geschichte der Philosophie (three vols. Berlin, 1836); Ritter, Geschichte der Philosophie (twelve vols. Hamburg, 1853); Schwegler, Geschichte der Philosophie (Stuttgart, 1848), translated by J. H. Stirling, with annotations, second edition 1868; Cousin, Cours de Philosophie Morale (1841); Lewes, Biographical History of Philosophy (4th edition, two vols. 1871); and Ueberweg, Grundriss der Geschichte der Philosophie, which has been translated into English by G. S. Morris (two vols. London, Hodder and Stoughton, 1872–74).

PHILOSOPHY, PERIPATETIC. See PERIPATETIC PHILOSOPHY.

PHILOSTRATUS, FLAVIUS, the Elder, a distinguished Greek Sophist and rhetorician, born at Lemnos about the middle of the second century of our era. Few facts regarding his life have come down to us. All we know is that he taught rhetoric at Athens, and subsequently at Rome, where he obtained the favour of the emperor Septimius Severus, and was received into the circle of *literati* that the empress Julia Domna had gathered around her. He accompanied this princess in her travels, and was still alive in the third century under the emperor Alexander. The date of his death, however, is unknown. His principal work is his Life of Apollonius of Tyana, undertaken at the desire of the empress, and which some critics have supposed to be a parody on the Gospels. His other works are the Heroica, a fictitious history of the heroes of the Trojan war, in the form of a dialogue; the Eikones, a description of certain paintings the author had seen at Naples; Vitæ Sophistarum, or the lives of several of the Sophists; Letters, &c. Among the editions of his collected works are those of F. Morel (Paris, 1709) and Kayser (Zürich, 1844–46).—PHILOSTRATUS, the Younger, a nephew of the preceding, was likewise a Sophist and rhetorician, but in every way inferior to his uncle, whom he rather servilely imitates in his Imagines.

PHILTRE, love potion. From the earliest times it has been supposed that there were means by which love could not only be excited but be directed to a particular object. Various substances from the animal and vegetable kingdoms have been used for this purpose, some disgusting, some injurious, some without any distinguishing character. The truth is, that

physical desire may be produced by physical stimuli, which are called *aphrodisiaca*, but it is absurd to suppose that such means can produce a passion for a particular object.

PHLEBITIS (Greek, *phleps*, a vein), inflammation of the veins. It may affect any of the veins of the body, but more usually manifests itself in the parts of the veins in the vicinity of wounds. Its seat is the cellular tissue of the vein, and the circular fibrous coat in as far as the latter exhibits any degree of redness or vascularity. When phlebitis is the primary disease it is the cause of the changes of the blood, &c., inside the vessel. On the other hand, it may itself proceed from the coagulation of the blood, poisonings, or other remarkable changes within the vein, in which case it is secondary. The disease is indicated by great tenderness, tension, acute pain, and a knotted, cord-like swelling or hardness in the course of a vein or veins, sometimes attended, when the veins are superficial, with discoloration. The inner surface of the inflamed vessel is supposed to throw out fibrinous fluid, which coagulates in layers, and finally closes the passage. In many instances the inflamed veins secrete pus, and if an artificial issue is not given to it the matter makes its way into the adjoining cellular tissue and forms abscesses, when it is peculiarly dangerous. The causes of the disease are numerous, but most usually consist of external injuries of various kinds, as punctures or wounds—especially when inflicted by a foul or poisonous instrument—fractures, lacerations, and the like; also the existence of abscesses with which veins communicate, and the imbibing by the veins of morbid matters from cavities in which morbid deposits accumulate, or from necrosed bones, &c. Women are peculiarly liable to this disease after parturition, as the veins of the womb are apt to become inflamed and communicate the inflammation to the venous trunks connected with them.

Phlebitis may be prevented by taking great care in the dressing of wounds, applying such a dressing as will prevent putrefaction. The treatment recommended for this disease is very various. In general 'it should vary with the causes of the inflammation, with the symptoms complained of, with the habit of body of the patient, with the presumed extent to which the disease has advanced, and with the situation of the inflamed vein.' In most cases the following treatment is likely to be found beneficial, namely, 'rest, warm fomentations and poultices, early incision of abscesses, evacuation of bile and fæces by one or two doses of calomel, opium to relieve pain and insure quiet of mind and body, and wine, especially if there has been great loss of blood' (Druitt's Vade Mecum).

PHLEBOTOMY (Greek, *Phlebotomia*, from *phleps*, a vein, and *temnein*, to cut), the act of letting blood by opening a vein. Among the ancients great regard was had to the place where the opening was to be made. At present the custom is to open one of the principal veins of the arm, the hand, the foot, the neck, or the tongue. The operation itself was anciently performed with a spring lancet; now for the most part with a simple lancet. Of the arteries, that of the temples is the only one which is opened, and that is done in cases of local complaints of the head. Another mode of letting blood is by cupping, or by the application of leeches for the purpose of extracting blood from places affected by inflammations. Phlebotomy is one of the most effectual means of the medical art, but its application is differently regarded by the most distinguished physicians. Hippocrates rarely resorted to it, for he considered the cure of fevers and inflammations as the work of nature, and regarded phlebotomy as a mode of weakening the efficacy of her operations. His followers applied it more frequently, sometimes even to excess. The schools of the empirics (250 B.C.), relying, like Hippocrates, on their own experience and on the observation of nature, endeavoured to determine the cases in which bleeding was indispensable. But medicine declined with the general decline of science. Greek physicians indeed still distinguished themselves among the Romans, but the sect of empirics had degenerated. Excessive bleeding again became common, until Asclepiades of Bithynia (Cicero's physician and friend) taught a new method of phlebotomy. He considered the cause of the greatest number of diseases to be redundance of blood, and on this account advocated the practice of bleeding, but principally for the alleviation of pain, and applied this remedy frequently in case of local affections. After him Celsus gave an account of the cases in which bleeding was necessary (A.D. 5), and his remarks and directions correspond exactly with those of the greatest modern practitioners. Aretæus, founder of a new school (A.D. 70), prescribed bleeding more frequently in acute than in chronic diseases, and in extreme cases he bled the patient to complete exhaustion. Galen (160), who referred the origin of a large class of diseases to excess of blood, ordered copious bleedings; and this practice gained great repute, and prevailed for several centuries. After the fall of the Roman Empire physicians were so scarce in Europe that Charlemagne died of an inflammation of the lungs, for want of bleeding and medical attendance. The Arabian physicians followed the authority of Galen, and spread his doctrine over Spain, Italy, and France. Bleeding was still more generally practised by the monks, who were in the sole possession of medicine as well as of all other science in those ages. At a later period astrology was connected with the medical art, and bleedings were prescribed on certain days. The popes, indeed, had often forbidden the monks to practise medicine; but they either disregarded the orders, or considered them as referring only to surgical operations. Thus surgery began to be separated from medicine, and formed a new profession, including the art of bleeding, applying leeches, and shaving. But when, after the invention of printing, the writings of the physicians of Greece, especially of Hippocrates, began to circulate, and their doctrines to revive, the practice of bleeding, at least among physicians, was again confined to certain cases. In Germany Paracelsus (1525) overturned the system of Galen, and with it the practice of bleeding, which was now confined to the surgeons and barbers alone. In France, Italy, &c., the method of Hippocrates and the degenerated system of Galen were, however, not yet abandoned, and the practice of bleeding was carried to the greatest excess. Helmont (1600), the founder of a new system, doubted the use of extracting blood, alleging against it that it weakened too much the vital spirit, which he called *archæus*. Harvey's discovery of the circulation of the blood (1619) had some influence on the modes of phlebotomy, in as far as it led to experiments (1642) by which medicines were infused immediately into the veins, or a portion of the infected blood extracted, and supplied by the blood of healthy men or animals. In England Sydenham rose (1673), who thought it possible to expel diseases by copious bleedings. He extracted blood in almost all cases, never less than 8 oz., generally 10 or more, and in cases of inflammation as much as 40 oz. The pernicious consequences of this practice did not escape him, but he thought he could not subdue disease by any other means. Stahl (1707) attempted to unite the system of Hippocrates with that of Helmont, and established correct and moderate principles of phlebotomy. He taught that abundance of blood was no disease, but might become so by a dispropor-

tion created between the solid and fluid parts of the system, in which case the proper balance ought to be restored. But he found bleeding indispensable in cases of too great excitement succeeded by a congestion or effusion of blood. To prevent this he prescribed occasional bleeding. His method was soon misunderstood and misapplied. The extraction of blood for the preservation of health was everywhere thought necessary. Bordeu endeavoured to stop this abuse in France. Cullen (1777), who regarded all diseases as proceeding from an unnatural state of the nerves; all irregularities of the fluids as the consequences of weakness and spasm, recommended bleeding as the best means to diminish the activity of the whole body, and especially of the system of the blood-vessels. He recommended, however, a due regard to circumstances, and mainly adopted Stahl's doctrine of the superabundance of blood. Stoll of Vienna (1780), an admirer of Sydenham, resorted frequently to bleeding. Several of the later physicians sought, however, to limit its too frequent application. Wollstein (1791) recommended it only in a few cases. Gall also improved the system still more. Brown adhered to the same maxim, and limited the practice of bleeding too much. Bleeding is one of the most effectual, but also one of the most dangerous means of checking disease.

PHLEGETHON, in the Grecian mythology, a river of fire in the infernal regions. See COCYTUS.

PHLOGISTON. This name was applied, before the time of Lavoisier, to a hypothetical substance supposed to be contained in all combustible bodies. See OXYGEN.

PHLOX (Greek, *phlox*, flame, referring to the bright colour of the flowers), a genus of herbaceous plants of the natural order Polemonaceæ, natives for the most part of North America, though some of the species are to be met with in Asia. The leaves are generally simple, entire, sessile, the lower ones opposite, and the upper ones alternate; the flowers are of a purple or violet colour, more rarely white or red. The corolla is salver-shaped, with a narrow sub-cylindrical tube, and longer than the calyx, which latter is deeply five-cleft and sub-cylindrical or sub-prismatic. The genus is perennial, and a great favourite with florists.

PHOCA. See SEAL.

PHOCAS, a Greek emperor, born in Asia Minor of obscure parentage, entered the army in the reign of Mauricius, and rose to be a centurion. While on the banks of the Danube he took a lead in one of the mutinies then of so frequent occurrence, and set out at the head of the disaffected on their march to Constantinople. Their approach compelled the emperor and his family to save themselves by fleeing to Chalcedon. Phocas took possession of the throne, and was formally crowned in 602. Mauricius, with his five sons, and shortly after all the members of his family, were cruelly butchered. Phocas immediately attempted to open a negotiation with the Persian monarch Khosru II., but the nature of his usurpation and the atrocities attending it caused his advances to be treated with disdain, and the Persians immediately came forward as the avengers of Mauricius and his family. The war thus inaugurated continued for twenty-four years, during the first eighteen of which the Persians were uniformly successful. But the Romish court was not so scrupulous as the Mohammedan court had proved; and Pope Gregory I. not only recognized the legitimacy of Phocas, but addressed a series of complimentary letters to him and his wife. The end which the pope had in view no doubt seemed to him to justify the means, and the infamy incurred by writing the letters was thought to be more than compensated by the liberal donations expected, and to some extent actually obtained from Phocas. Boniface III. and IV., the immediate successors of Gregory, pursued the same policy; and if we can believe the Papal chronicler Anastasius, this atrocious imperial usurper formally acknowledged the pope to be the head of all Christian churches. Vengeance had lingered long, but it at last overtook him. Heraclius, exarch of Africa, fitted out a powerful armament by sea, and at the same time sent a powerful army by land, the one commanded by his son Heraclius, and the other by his nephew Nicetas. The combined forces met before Constantinople, which made but a feeble resistance, disaffection within giving powerful aid to the assault made from without. Phocas was among the captives, and ended his life in 610 by a death as cruel as those which he had inflicted. The younger Heraclius immediately took possession of the vacant throne.

PHOCION, an Athenian general, and one of the most virtuous characters of antiquity, is supposed to have been born about B.C. 402. Though of humble descent, he received a good education, and imbibed under Plato and other philosophers those elevated sentiments which governed his whole life. He first served under Chabrias, and his activity contributed essentially to the naval victory of Naxos (377 B.C.) In the war with Philip of Macedon the Athenians sent Phocion with some troops to Eubœa, where he obtained a complete victory over the enemy. He banished Plutarchus, who had made himself tyrant of Eretria, and left the island secure from the attacks of Philip. Some time after he was despatched by the Athenians to assist the cities of the Hellespont against Philip, whom he compelled to retire. His honesty, disinterestedness, and patriotism were so generally acknowledged that he was nominated commander forty-five times without once applying for the office. He always led a simple life, and cultivated his small farm with his own hands. When Philip appeared in Phocis with a view to attack Attica, Phocion in vain advised peace. The battle of Chæronea in 338 proved the soundness of his advice. The Athenians disregarded the advice of Phocion not to take part in the assembly of the Grecian States, convened by Philip, till they knew the intentions of the king, and in consequence found themselves obliged to furnish Philip with a quota of cavalry and galleys. This they were reluctant to do, but Phocion advised them to submit to adversity with patience. After Philip's death in 336 Phocion advised the Athenians not to expose themselves to new disasters by joining a confederacy against the young Alexander. His opinion was justified by the event. When, after the destruction of Thebes, Alexander demanded of the Athenians the deliverance of the orators who had spoken so violently against him, Phocion undertook the commission of appeasing the anger of the king with the happiest success. Alexander conceived a great affection for him, and sent him a present of 100 talents, which he declined. The deputies found him carrying water, while his wife was baking bread. But not to displease the king, he requested the liberation of some of his imprisoned friends, a request which was at once complied with. After Alexander's death in 323 the project was formed of freeing Greece from the Macedonian yoke. Phocion disapproved the measure, though he accepted the command. The Athenians were at first successful; but Antipater soon obtained the superiority, and threatened Athens, which was instantly abandoned by the orators who had been so clamorous for war. Phocion succeeded in obtaining peace, but on very hard conditions, and all his efforts were directed to mitigate the heavy burdens of his

country, and to turn his influence with the Macedonians to its advantage. Nevertheless Phocion was accused of having acted against the good of his country, and of having betrayed it to the enemy. He was compelled by clamours and accusations to take refuge in Phocis, but was delivered up to the Athenians by Polysperchon. Phocion, with several of his friends, was condemned to death unheard. His calmness continued unshaken. 'Tell my son,' said he to a friend who asked if he had any commission for him, 'to forget that the Athenians have been unjust to me.' When many had drank the fatal draught, it was observed that there was not enough remaining for the rest, and the officer who administered it refused to procure more without pay. Phocion requested a friend to pay him, and said jestingly, 'It is not even allowed us to die gratis in Athens.' His body was thrown unburied beyond the limits of Athens, but his friends carried it to Eleusis, and burned it in the house of a Megarensian woman. The Athenians became sensible of their injustice; they procured his remains, buried them at the public expense, erected a monument to his memory, and punished his accusers.

PHOCIS (Greek, *Phōkis*), a division of ancient Greece, bounded on the north by the Locri Epicnemidii and Opuntii, on the east by Bœotia, on the west by the Locri Ozolæ and Doris, and on the south by the Gulf of Corinth. The principal rivers were the Cephissus and Plistus, and the principal mountain Parnassus. Phocis was a mountainous and unproductive country, the valley of the Cephissus being almost the only fertile tract in it. According to tradition the earliest inhabitants were the Leleges, Thracians, Abantes, Hyantes, and subsequently the Phlegyæ, an Achæan tribe. The Phocians are said to have derived their name from Phocus, son of Ægeus, who conducted hither an Ægenetic colony. They were an industrious people, and subsisted chiefly by agriculture. They were distinguished for their bravery, of which they gave a signal proof in the war with the Thessalians, and in the Persian and Peloponnesian wars, in which last they took part as allies of the Spartans. They were the cause of the Sacred war, so destructive to Greece, and shared the general fate of their countrymen after the battle of Chæronea (B.C. 338). See GREECE (ANCIENT).

PHŒBUS. See APOLLO.

PHŒNICIA (Greek, *Phoinikē;* Latin, *Phœnice*, and later *Phœnicia*), a country on the coast of Syria, bounded on the east by Mount Lebanon. Various derivations have been assigned to the Greek name. Some would take it from the eponymous *Phœnix*, son of the first king Agenor; others from *phoinix*, the palm-tree; others from *phoinix*, the purple dye, which formed an important article of Phœnician commerce; while others again, from the old tradition that the Phœnicians came from the Red Sea, regard *phoinix* as but the rendering of *eruthros*, 'red,' the epithet given to the Arabian Gulf, and in Herodotus to the northern portion of the Indian Ocean. By the Phœnicians themselves, and by the Israelites, the country was called Chna or Canaan, which signifies the 'low country' or lowlands, in contrast to the eastern 'heights,' at the base of which it was situated. Canaan, however, came generally to signify the whole country of Palestine, in relation to the mountains or table-land of Gilead and Aram—the highland region to the north and east. The expression 'Tyre and Sidon' often represents the whole country of Phœnicia.

Phœnicia in its narrowest acceptation, or Phœnicia proper, was a tract of country stretching along the eastern shore of the Mediterranean: not much more than 28 miles in length, and little more than 1 mile in average breadth; Sidon being situated near its northern, and Tyre not far from its southern boundary. In its widest sense, as in Strabo, Phœnicia seems to have meant the whole seaboard from the Gulf of Issus to the southern desert—'from Orthosia to Pelusium'—a length of 450 miles (Geog. xvii. 11, 20). But generally Phœnicia was regarded as beginning at the north with the Island of Aradus, and extending south to the town of Dora, a little below the promontory of Carmel; being about 120 miles in length, and rarely more than 20 in breadth; lying about lat. 32° 38′—34° 52′ N., and lon. 35°—36° E. It is watered by several streams flowing from the western declivities of Lebanon to the sea; such as from its northern frontier and in order southward, the Eleutherus, the Adonis, the Lycus, the Tamyras, the Bostrenus, the Leontes, and the Belus. The country, with its varieties of climate, was fertile; pine, fir, cypress, cedars, terebinths, sycamores, fig, palm and olive trees, and acacias crown the heights; on the lower regions are found wheat, rye, and barley, together not only with ordinary fruit, but also with apricots, peaches, pomegranates, almonds, citrons, sugar-canes, grapes, bananas, all growing luxuriantly, and forming a forest of finely tinted foliage. The lowlands further yield silk, cotton, indigo, and tobacco. The only metal found is iron, which occurs in considerable quantities in the hills above Beyrout (the ancient Berytus). The whole country is subject to earthquakes, the effect of volcanic agency. Besides the great cities of Sidon and Tyre, the country was studded with numerous smaller towns; 'forming,' as Heeren says, 'almost an unbroken city, extending along the whole line of the coast, and over the islands.' Among these towns in earlier times were Arvad, Accho, Orthosia, Arka, Tripolis, Botrys, Berytus, Sarepta, Dora, &c. Many of the roadsteads or harbours were excellent, but are now silted up by the currents which carry the alluvial soil brought down by the Nile to the eastward.

The question of the origin of the Phœnicians has as yet received no satisfactory solution. According to Herodotus they described themselves as immigrants from the shores of the Erythræan Sea, a report confirmed by Justin. Strabo writes that in the Persian Gulf there were two islands called Tyros or Tylos, and Aradus, with a town named Dora, in which there were temples similar to those of the Phœnicians, and the inhabitants of those places related that the Phœnicians had quitted them to found new colonies. The Erythræan Sea, in its widest sense, includes the Red Sea, the Persian Gulf, and the northern part of the Indian Ocean confined between the eastern shores of North Africa and the western shores of Hindustan; and as the writer of Genesis calls Canaan the son of Ham the founder of the race, some investigators have concluded that the Persian or Arabian Gulf is the original home of this people. Against such conjectures, however, important arguments have been adduced from the genuine traditions of the Phœnicians themselves, as preserved, not in a corrupted Greek state, but in their myths, in the biblical accounts, and in their language, which in its most ancient forms is purely Semitic. Their immigration to the coast of the Mediterranean belongs to prehistoric times. The probability is that it did not take place from one region or at one time, and that many centuries elapsed before they were fused into one nationality. The settlement of Israel in Canaan did not produce any great or permanent change on Phœnicia. The tribes of Naphtali, Asher, and Dan, to which it was assigned, did not conquer Phœnicia, but occupied only a small portion of it. The canton of Dan reached to Joppa, and in the struggle with Jabin he remained

'in his ships,' as if made effeminate and worldly by commerce. Asher, who had obtained a partial footing, had also lost patriotic spirit, and 'abode in his breaches' (creeks). The relation of Israel to Phœnicia was quite different from that of Israel to Philistia—the latter being that of continuous feud, alternative conquest or armed peace; the other becoming one of amity, intercourse, reciprocal advantage, and 'brotherly covenant.' Such alliance was not indeed unbroken, for we read of early Sidonian oppressions. But at a later period 'Hiram,' king of Tyre, was 'ever a lover of David;' and in the reign of Solomon the servants of Hiram prepared cedar and fir wood for the temple, hewing the trees in Lebanon, and conveying them by sea 'in floats;' while Solomon in return gave him, 'year by year, twenty measures of wheat and twenty measures of pure oil'—food so abundant in the one country being given in exchange for skilled labour which the other could so easily furnish. The Phœnicians, alive to their true interests, sought to colonize and not to conquer. Wars would have been fatal to their commercial prosperity. Their wealth and power arose from their command of the sea, and it was their policy not to provoke any of the nations to the east of them, and not to quarrel unnecessarily with Israel—which was their granary—the relation between Hiram and David being probably but a sample of such international treaties and intercourse. After David had conquered Edom, Ezion-geber on the Red Sea became a Hebrew port, and 'Solomon had a navy of ships.' As the Hebrews had not been trained to navigation, they took advantage of their neighbours' experience, and Phœnician crews partially manned each of their vessels, for 'Hiram sent in the navy his servants, shipmen that had knowledge of the sea, with the servants of Solomon.' The result was a sudden and great accession of wealth and luxuries—the navy of Tarshish returned every three years bringing 'gold and silver, ivory, and apes, and peacocks,' so that 'silver was nothing accounted of in the days of Solomon'—nay, it was 'made to be in Jerusalem as stones.' After the division of the Hebrew kingdom Phœnicia would naturally cultivate alliance with the Ten Tribes nearest to it, and Ahab married a Phœnician princess. The joint commercial voyages probably were not prosecuted during any long period, as the Jews had no liking for the sea. Indeed, the trade seems to have been abandoned for some time, when Jehoshaphat attempted to restore it. Ahaziah, on the strength of old traditions, and because of his mother's Phœnician connection, sought a share in the enterprise, and was at first refused. Afterwards the refusal seems to have been modified, and a partnership was admitted, on account of which the enterprise was frustrated. The history of Phœnicia in its special points, its commerce, and the invasions which it suffered from Babylon, Persia, and Greece will be best considered under Sidon and Tyre (which see).

Herodotus describes the Phœnicians as beginning soon after their settlement to occupy themselves in distant voyages. From the construction of rude rafts they must speedily have reached to a style of substantial ship-building. Their commercial vessels are represented either as long in shape, and fitted both for sailing and being rowed with fifty oars—'ships of Tarshish;' or as rounder in form and more capacious in stowage, but slower in speed—bearers of cargo on short voyages. Xenophon passes a high eulogy on a Phœnician ship—'the greatest quantity of tackling was disposed separately in the smallest stowage.' Their merchantmen also carried arms for defence, and had figures on their prow, which the Greeks named *pataikoi*. They steered by the Cynosure, or the last star in Ursa Minor; and they could cast reckonings, from the combined application of astronomy and arithmetic. This nautical application of astronomy is ascribed by Callimachus to Thales, a Phœnician by descent. Lebanon supplied them with abundance of timber, and Cyprus gave them all necessary naval equipments, from the keel to the top-sails. These daring Phœnician navigators in the reign of Pharaoh-Necho circumnavigated Africa—departing from the Red Sea and returning by the Straits of Gibraltar. They reported that in sailing round Libya they had the sun on their right hand—a story of which Herodotus says, 'I, for my part, do not believe them,' and yet it is the positive proof that they had gone round the Cape. Diodorus speaks also of Phœnician mariners being driven westwards beyond the Pillars of Hercules into the ocean, and reaching at length a very fertile and beautiful island—'a dwelling of gods rather than of men'—one probably of the Azores or Canary Islands. The Phœnicians furnished to Xerxes 300 ships, but they were defeated at Salamis.

The remote periods of Phœnician commerce and colonization are wrapped in myths. Phœnician ships may have first carried the produce of Assyria and Egypt—but their own wares and manufactures were soon largely exported by them. The commerce of Tyre reached through the world. (See TYRE.) It traded in the spices, cinnamon, and stones of Arabia; in the myrrh and frankincense of Sabæa; in ivory, ebony, 'bright iron,' and cotton fabrics from India; in linen and corn from Egypt; in wine and wool from Damascus; in embroideries from Nineveh and Babylon; in wheat, balm, and oil from Judæa; in pottery from Attica; in skins of lions, panthers, and elephants from Mauritania; in horses and chariots from Armenia; in copper and its mixtures from the coasts of the Euxine; in lead and other metals from the south of Spain; and in tin from the coasts of Cornwall and Devonshire. There was also a great trade in the tunny fisheries, and the Tyrians sold fish in Jerusalem. Phœnicia excelled in the manufacture of the purple dye extracted from the shell-fish murex, so abundant on parts of its coasts. This colour in its richest hue was at length appropriated to imperial use, and the silk so dyed was of extraordinary value. The glass of Sidon was no less famous than the Tyrian dye—the fine white sand used for the process being very abundant near Mount Carmel. Glass has been found in Nineveh, and glass-blowing is figured at Beni-Hassan in Egypt. The art might have come from Egypt, but the discovery in Phœnicia is represented as accidental. The pillar of emerald shining brightly in the night, which Herodotus speaks of as being in the temple of Hercules, was probably a hollow cylinder of glass with a lamp within it. Phœnicia produced also drinking cups of silver and gold. Homer describes Sidon as abounding in works of brass. Its building stone was not of very good quality, but cedar-wood was largely employed. When stone was used the joints were bevelled—a practice which also characterizes Hebrew architecture, and gives it a panelled appearance. The mining operations of the Phœnicians were also celebrated. Herodotus says that they turned a mountain over in the search for gold. Mines were wrought in the various colonies—in the Grecian islands and in Spain—by processes much the same as those employed in more modern times.

The marine knowledge and experience of Phœnicia led to the plantation of numerous colonies in Cyprus, Rhodes, Cilicia, and the islands of the Ægean—the Cyclades and Sporades—in Sicily, in Sardinia, the Balearic Islands, and in Spain. Strabo says that the Phœnicians possessed the best parts of Iberia

before the days of Homer. One principal colony was in Northern Africa, and Strabo asserts that they occupied the middle part of Africa soon after the Trojan war. The story of Dido and the foundation of Carthage is well known, the event being generally placed between 800 and 900 B.C., though some place it as early as before 1200 B.C. Byrsa, the name of the hill on which the city was built, denotes a fortress, being Bozrah, the name also of the Idumæan capital; though its Greek form gave rise to the story about the purchase of as much land as a hide would measure. Carthage means 'new town,' and Punici is only another spelling of Phœnici. Intercourse with many strange and untutored races led the Phœnicians to indulge in fictions, and love of gain taught them mercantile deceits and stratagems. 'Phœnician figment'—*pseusma phoinikikon*—or a traveller's tale, was proverbial in former times, like *fides Punica* at a later period. The Etymologium Magnum bluntly defines *phoinikikon* by *to pseudos*, the lie. In the *Odyssey* they are described as 'crafty,' or as 'crafty and wicked.' As a trading nation they were ready sometimes to take advantage of the ignorant and savage tribes with which they bartered, and they cared nothing for law or right on the high seas, where no power could control or punish; so that Ulysses uses the phrase *Phoinix anēr apatēlia eidōs trōktēs*, 'a Phœnician man knowing deceitful things —crafty.' They were often pirates; they were certainly slave-traders. They purchased slaves from the northern shores of the Black Sea, and they also kidnapped and sold the children of Israel. This nefarious practice brought upon them the severest denunciations of the prophets, and a just retaliation was predicted to fall upon them. The terms 'Canaan,' 'Canaanite,' or 'man of Canaan,' the native name of the Phœnician, is sometimes rendered 'merchant' in the English version. 'Phœnician' and 'merchant' were thus interchangeable terms; so that in Greek *Phoinix ginomai* means, 'I become a trader.' But the phrase seems to have sunk in moral meaning, and trader was but another name for a hucksterer, or a pedlar going from house to house, as in Pro. xxxi. 24. Nay, the prophet Hosea says, 'He is a Canaanite,' or 'Phœnician,' or 'as for Canaan, the balances of deceit are in his hand: he loveth to oppress.' A common proverb expressive of fraud matching fraud was 'Syrians against Phœnicians.' No coined money of Phœnicia is extant prior to its subjugation by the Greeks. The standard seems to have been the same as the Jewish; the shekel being equal to the Attic tetradrachm; and the *zuz*, which occurs on the tablet of Marseilles, being of the value of a denarius. On the same tablet *keseph* (silver) occurs, with the probable ellipse of 'shekel,' as in Hebrew. Foreign silver money is also there referred to. Among the antiquities dug up in Nineveh are several bronze weights in the form of lions; having both cuneiform legends with the name of Sennacherib, and also Phœnician or cursive Semitic inscriptions. The *cor* was a Phœnician measure, the same as the Hebrew chomer, and holding 10 Attic metretæ, each metretes being equal to about 10½ gallons. The arithmetical notation was carried out by making simple strokes for the units; ten was a horizontal stroke or a semicircle, twenty was represented by the letter N, and 100 was also a special sign, the unit strokes added to it denoting additional hundreds. The intercourse of the Phœnicians with so many distant countries gave new words to both Hebrews and Greeks. Such words expressing the objects in which they traded were a national importation. Thus in Hebrew we have *almug*, *shen-abbim*, *koph*, *tukkyim*—Indian or Sanskrit terms denoting the curiosities which Solomon's fleet brought back. They also added to the tongue of the Greeks such terms as *murrha*, *kassia*, *hussōpos*, *nardos*, *kinnamōmon*, *bussos*, *kamēlos*, *arrhabōn*, (myrrh, cassia, hyssop, nard, cinnamon, yellow flax, camel, earnest-money), words which are only Greek forms of Phœnician ones; just as we have muslin, bayonet, damson, cordovan, and currant—names of things imported, and the names are now naturalized.

As was the case in Canaan at the invasion, each Phœnician city was governed by a king or petty chief. A powerful aristocracy existed in the chief towns, and may have formed a deliberative assembly on great occasions. There were also elective magistrates, called by the Romans *suffetes*, a disguised form of the Hebrew *soffet;* and two officers so named the Phœnician colony of Carthage placed annually at the head of their government. Sidon, and afterwards Tyre, exercised a hegemony over the other states; yet the jealousy of the three great towns was so keen that they met for consultation on common ground at Tripolis, where each of them had a district separated from the others by a stadium. The relation of Phœnicia to her colonies, so numerous and so distant, does not seem to have been, as indeed it could not be, very close. Thus we read that the Danites, when they sought them an inheritance, marching in an armed band, came to Laish, and took it so easily, 'because there was no deliverer, and it was far from Zidon.' Their religion, however, bound the mother country and the colonies in a common worship. Carthage often sent presents to the great god; so did Gades and other settlements.

While the wealth and commerce of Phœnicia must have brought art and refinement, the people, as has commonly happened, were noted for their dissoluteness. The Western World often traced its corruption to Phœnicia. Phœnician songs are stigmatized by Athenæus as rude and indecent, and *phoinikizōn* is one who is brutally lustful. Effeminacy and licentiousness sapped the natural power of self-defence, and led the Phœnicians to the employment of mercenaries. A rich and unwarlike people could not but lure the conquerors to an easy prey, and such came in succession from Assyria, Babylon, Persia, and Rome.

The religion of the Phœnicians was a species of nature-worship, the objects of adoration being the sun, moon, and five planets; or in another form it was the worship of male and female reproductive powers—the former represented as Baal and the latter as Baalith, Ashtoreth, or Astarte. The worship of Ashtoreth became as degraded and licentious as that of Mylitta at Babylon. Large troops of hierodulæ (prostitutes) ministered to the goddess. These ministers did not belong to one sex—there was the emasculated as well as the licentious. This impure and unnatural worship, so opposed in letter and spirit to the Mosaic law, was tolerated in the very vicinity of the temple. But the worship which was so licentious on the one side was inhuman and bloody on the other. The god called Il, a sort of Phœnician Cronos or Saturn, had human sacrifices offered to him. His image was of bronze, and, according to the description of Diodorus, resembled that of Moloch or Milcom, the god of the Ammonites, to whom children were sacrificed. After a triumph they also sacrificed beautiful captives. Their literature having perished it is impossible to arrive at any minute knowledge of Phœnician polytheism and its ritual. In some parts of the country they practised circumcision, though the rite does not seem to have been common among their nearest neighbours of the interior and the coast—the Canaanites and Philistines. Their cosmogony, as given in the remains of Sanchoniathon, is peculiar, and is ascribed to Taut—Thoth

or Hermes. From the wind, Kolpiia (the voice of the mouth of Jah), and Baau, his wife, were produced the two first mortals; these had three sons, Light, Fire, and Flame, who produced a race of giants from whom the mountains—Casius, Libanus, Brathy, &c.—were named, and who with their descendants discovered the various arts of life. In later times the gods were regarded as merely deified men, and this new mythology was absurdly enough grafted on the older cosmogony. Elyon (the Mighty One) and his wife Beruth are their progenitors, who dwelt near Byblus. From Elyon descends Heaven, who weds his sister Earth, and begets four sons, Il, Betutus, Dagon, and Atlas. Heaven deposes his father, and kills his own son, Sadid, and one of his daughters. The sun and moon were revered in conjunction with Baal and Astarte. The proper name of Baal is Baalsamen, 'lord of the heavens.' This name Baal is compounded with many proper names—Ethbaal, Jezebel, Hannibal, Asdrubal; and with names of places, as Baal-gad, Baal-hamon, Baal-shalisha, showing the prevalence of his worship over the land even after the Hebrews had taken possession of it. Among a seafaring people marine deities must have held a prominent place—deities corresponding to Nereus and Poseidon, which last was worshipped at Berytus. The Cabiri (Strong Ones) presided over navigation, and are in many respects of similar rank and prerogative with the Dioscuri—the protectors of sailors. In the oldest temples there were no images; what Tacitus calls the *effigies humana* was absent. But there were rude fetishes—conical or oblong stones, the larger ones perhaps aerolites 'fallen from heaven,' and the smaller ones possibly fossil belemnites. Such a stone was called by the Greeks *baitulos*, and Bochart and others of a former age traced these to Bethel and to the pillar which Jacob erected there.

The language of ancient Phœnicia may be generally called Hebrew, or the language now commonly understood by that designation. Jerome and Augustine distinctly bear this testimony. According to the first the one tongue was *confinis* to the other; according to the latter almost all the words, *pene omnia*, of the two tongues were the same. The famous passage in the Pœnulus of Plautus illustrates the assertion. Act v. scene 1 contains in sixteen lines the Phœnician translation of the Latin text, with upwards of 100 Phœnician words. Several other phrases and words are found in the two following scenes. Phœnician or Punic words are quite intelligible from their relation to Hebrew. Thus Jerome says that in that tongue a virgin is called *almah*. Messias, according to Augustine, was Messe in Punic; and similar are Bel or Baal, Adoni, Malka, &c. Of ninety-four words on a tablet discovered at Marseilles in 1845 relating to the sacrificial ritual no less than seventy-four are found in the Old Testament. Coins and seals also disclose the same affinity as do the numerous inscriptions on stones found in many places in Cyprus, Malta, Sidon, Sicily, Sardinia, and Africa. Proper names can all be explained in the same way. Melkarth, called on a Maltese inscription the Tyrian Baal, is a compound of two words which in Hebrew signify king of the city. Hanno, one of the commonest Punic names, is from *han*, favour, grace, the same in meaning with Joannes, John; Anna, the sister of Dido, is the same as Hannah, mother of Samuel. Dido herself, 'his love,' is of the same root as David; Hannibal is the 'grace of Baal;' Asdrubal the 'help of Baal;' Carthage, as we have seen, is 'new town.'

The invention of letters is often ascribed to the Phœnicians. The Greeks believed that letters had come to them from Phœnicia. As the works and wanderings of the Tyrian Hercules mythically picture the progress of Phœnician colonization, so Cadmus represents in the same way the influence and spread of Phœnician culture. Letters were said to have been brought to Greece by Cadmus—an eastern man. The so-called Cadmean letters of the Greek alphabet are Α Β Γ Δ Ε F Ι Κ L Μ Ν Ο Π Ρ Σ Τ, the sixth letter F being the Hebrew ו, or the digamma. The names of these letters have no meaning in Greek, but they have each a significance in Phœnician or Hebrew. Thus Α is *aleph*, an ox, Β, *beth*, a house, Γ, *gimel* or *gamal*, a camel, Δ, *daleth*, a tent-door, and Τ, or *tau*, a cross. The tongue in which these names are significant must be an old one, for the written sign was probably at first a rude sketch of the object, and the initial sound of its name became the power and expression of the letter. The affinity of the old Greek letters in form to the Phœnician and early Hebrew can be easily traced. The names of many of the Cadmean letters end in *a*, the emphatic form of an Aramaic noun—a presumption, as some suppose, in favour of an Aramaic origin, or perhaps only of an origin from the northern confines of Phœnicia.

The literature of Phœnicia has perished. A few fragments of Sanchoniathon have been preserved by Eusebius, but their genuineness is now denied by such scholars as Movers, and they are regarded as a forgery made by Philo Byblius, who professes to translate them into Greek. Mochus is referred to as the author of an atomic theory. Theodotus, Philostratus, Menander, Dius, Hieronymus are called Phœnician writers, but little more than their Greek names remain, with brief allusions or extracts in the Christian apologists. Still, if excavations were made with care in these old Phœnician towns, as have been made at Nineveh and other places, many relics of interest would no doubt be brought to light. As a specimen of what may be anticipated, Thomson (The Land and the Book) describes the finding at Sidon in January, 1855, of a sarcophagus, which was bought by the Duc de Luynes, and is now in the Louvre. The long inscription on the lid, in Phœnician characters, which have been deciphered, tells that the sarcophagus is that of King Ashmunazer, and it must belong to an early period, for he calls himself the possessor or conqueror 'of Dor, Joppa, and ample corn-lands at the root of Dan.' There are two kinds of Phœnician writing which can be clearly distinguished. The ancient form, which is purer, more orthographical, and very neatly inscribed, is found on the monuments of the mother country itself, and of her colonies in Malta, Carthage, Citium, and Athens; the later form, in which the language is corrupt, the letters less artistically cut, and even mixed with strange (probably degenerate) characters, is to be met with in the inscriptions found in some parts of North Africa, Cilicia, Cyprus, Sardinia, Spain, &c.

Among books on Phœnicia and the Phœnicians we may mention Barthélemy, Reflexions sur quelque Monumens Phœniciens (in 1795); Kopp, Bilder und Schriften der Vorzeit (1834); Hamaker, Diatribe de aliquot Monumentis Punicis, &c. (1822); Raoul-Rochette, Monumenta Phœniciæ (1828); Gesenius, Scripturæ Linguaeque Phœniciæ Monumenta quotquot supersunt (1837); Movers, Die Phönizier (vol. i. 1841, vol. ii. 1850), and Phœnizien, in Ersch and Gruber's Allgemeine Encyclopädie; Kenrick, Phœnicia (1855); Davis, Carthage and her Remains (1861); Rénan, Missions de Phénicie (1864–74).

PHŒNIX, a fabulous Egyptian bird, about the size of an eagle, with plumage partly red and partly golden. According to the story told to Herodotus the bird came from Arabia once every 500 years to the sanctuary particularly dedicated to it at Heliopolis, bringing with it the dead body of its parent, which it inclosed in a large egg of myrrh, and buried in the shrine. It is further related that when it felt its life

drawing to a close it built itself a nest, to which it imparted the power of generation, so that after its death a new phœnix rose out of it; while other versions speak of a worm, which proceeding from the body of the dead bird was developed into a new phœnix. A more modern and popular modification of the story runs that the bird, at an age of 500 years, conscious of its approaching death, built a funeral pile of wood and aromatic gums, which it lighted with the fanning of its wings, and rose from the flames with a new life. Similar stories of marvellous birds occur in the oriental mythologies, as, for instance, the myth of the Persian bird *simorg* and that of the Indian *semendar*. Ancient writers mention four periods as having been marked by the appearance of the phœnix in Egypt: under Sesostris, under Amasis (569–525 B.C.), under Ptolemy III. (284–286 B.C.), and under Tiberius (34 A.D.) In the Clementine epistle to the Corinthians it is now and again used as an illustration of the doctrine of the resurrection; it had been regarded by the Egyptians as the symbol of immortality thousands of years previously; it appears on the coins of several Roman emperors as a symbol of their own apotheosis or as the dawn of a more glorious era under their reign.

PHOLAS, a genus of Lamellibranchiate Mollusca belonging to the section Siphonida of that class. This genus forms the type of the family Pholadidæ, in which the shell gapes at both ends. It is of thin white texture, and studded over on its outer surface with numerous rasp-like prominences. Accessory pieces or valves are present in the shell, which also exhibits transverse ridges and longitudinal furrows on its exterior. The *umbones* or beaks of the shell are covered with callosities. No hinge or ligament exists in the shell. The animal is club-shaped and thick, and possesses a short obtuse 'foot.' The breathing-tubes or 'siphons' are very long, and united to nearly their tips, which exhibit fringed edges. The mantle lobes are united or closed in front.

These molluscs form typical examples of *lithodomous* or 'stone-boring' molluscs, since they excavate burrows in rocks of various kinds, and live within these burrows, their siphons forming the media through which communication is kept up with the outer world. Various theories have been advanced to account for the mode in which the burrows are excavated. The hypothesis of a chemical solvent was long debated; whilst the action of the foot and of imbedded silicious particles was similarly contested for. The true explanation depends upon the recognition of the shell and its rasp or file like surfaces as the boring organ; and by means of this structure, together with the jets of water from the siphons, as tending to carry off waste particles, the hardest rock is in due time excavated. These shells are popularly known as 'piddocks,' and are eaten on many parts of the British coasts. The common species is the *Pholas Dactylus;* and the *P. candida*, *P. parva*, and *P. crispata* are also found in Britain. *P. papyracea* and *P. melanoura* are additional examples. These molluscs appear to possess the power of emitting a phosphorescent light, *P. Dactylus* being specially noted on this account.

PHONETIC WRITING. See WRITING.

PHONOGRAPHY. See SHORT-HAND.

PHOSGENE is the name given to a gaseous body which is produced by the action of direct sunlight on a mixture of equal volumes of carbon monoxide and chlorine, thus $CO + Cl_2 = COCl_2$.
Phosgene.

PHOSPHIDES, compounds of phosphorus with one other element, more especially with the metals.

PHOSPHORESCENCE is the property which certain bodies possess of becoming luminous without undergoing combustion. Inasmuch as phosphorus exhibits this property in a marked degree, the name has been hence derived. Two pieces of quartz emit light on being rubbed together. Light is seen in breaking lumps of sugar. A variety of blende (sulphide of zinc), on being scratched with a knife, emits a fine yellow light. In the year 1663 Mr. Boyle observed that the diamond, when slightly heated, rubbed, or compressed, emitted a light almost equal to that of the glow-worm. The most complete account we possess of the phosphorescence of minerals is that furnished by Sir D. Brewster. He obtained his results by placing fragments of the bodies examined upon a thick mass of iron heated a little below redness, or introducing them into a pistol-barrel similarly heated. The following table presents some of his results:—

Name of the Minerals.	Colour of the Minerals.	Colour of the Light.
Fluor spar.	Pink.	Green.
"	Purple.	Bluish.
"	Bluish white.	Blue.
"	White.	White sparks.
Calcareous spar.	Transparent.	Yellowish.
Apatite.	Pink.	Yellow.
Arragonite.	Dirty white.	Reddish yellow.
Harmotome.	Colourless.	
Topaz.	White and bluish.	Bluish. "
Rubellite.	Reddish.	Scarlet.
Petalite.	Reddish white.	Bright blue.
Anatase.	Dark brown	Reddish yellow.

The phosphorescence of anatase is entirely different from that of the other minerals. It appears suddenly like a flame, and is soon over. Certain varieties of fluor require no more heat than that of the hand to occasion the emission of light. The phosphoric light of minerals has the same properties as the direct light of the sun. The foregoing are instances in which it was not necessary to expose the bodies to the light previous to their exhibiting phosphorescence. Certain artificial compounds emit light in consequence of the action of extraneous light. The most powerful of these is the compound called Canton's phosphorus. It is formed by mixing three parts of calcined oyster-shells in powder with one of flowers of sulphur, and ramming the mixture into a crucible, and igniting it for half an hour. The bright parts will, on exposure to the sunbeam, or to the common daylight, or to an electrical explosion, acquire the property of shining in the dark, so as to illuminate the dial of a watch, and make its figures legible. It will, indeed, after a while, cease to shine; but if we keep the powder in a well-corked vial, a new exposure to the sun's light will restore the phosphorescent quality. When the electric discharge is transmitted along the surfaces of certain bodies, or a little above them, a somewhat durable phosphorescence is produced. Sulphate of baryta gives a bright green light, acetate of potash a brilliant green light, and rock-crystal a red and then white light. Temperature has a marked effect on the emission of light by these bodies. When they are shining, the luminous appearance ceases if they are exposed to the cold of a freezing-mixture. It becomes more vivid by applying heat; and if it has ceased, it may be renewed by applying a stronger heat. The following fluids have been found by Sir D. Brewster to be phosphorescent when poured into a cup of heated iron:—Albumen (white of an egg) diluted in water, isinglass in solution, saliva, soap and water, solution of rhubarb, solution of common salt, solution of nitre, tallow (the phosphorescence of which may be observed when a candle is extinguished in a dark room), alcohol, oil of dill-seeds, and oil of olives. In most of the instances of phosphorescence enumerated above

there appears to be no chemical change taking place in the body which emits the light. The change is purely mechanical; by heat, by friction, or by electricity the molecules of the body are caused to vibrate so rapidly that the phenomenon of light is produced. The substances which exhibit this kind of phosphorescence are generally bad conductors of heat and of electricity. In other instances, however, phosphorescence is accompanied with a true chemical change; thus a stick of phosphorus emits a pale blue light in the dark. The phosphorus is here slowly oxidizing, with formation of the new substance phosphorus trioxide (P_2O_3).

PHOSPHORESCENCE (ANIMAL) and LUMINOUSNESS is the name applied to the scintillating or phosphorescent light emitted from the bodies of certain marine animals. This phenomenon is well seen on the surface of the ocean at night. Each movement of the vessel or of the oars, or each ripple of the waves, causes gleams of a weird light to pass over the surface of the sea, or starts sparks of light in its depths. The phenomenon is well described by Sir Walter Scott in his Lord of the Isles:—

> 'Awaked before the rushing prow
> The mimic fires of ocean glow,
> Those lightnings of the wave;
> Wild sparkles crest the broken tides,
> And flashing round the vessel's sides,
> With elfish lustre lave;
> While, far behind, their livid light
> To the dark billows of the night
> A gloomy splendour gave.'

Coleridge, in his Ancient Mariner, and the poet Crabbe, also refer to this luminosity, the latter remarking—

> 'The fiery sparks those tangled fronds unfold—
> Myriads of living points; th' unaided eye
> Can but the fire, and not the form descry.'

Quatrefages, describing the luminosity of the sea off the Sicilian coast, says: 'The waves, as they broke along the rocky shore, encircled it with a glowing band of light, while every projecting cliff was circled with a wreath of fire. Our boat seemed as if it were opening for itself a passage through some glowing and fused liquid, whilst in its wake it left a long track of light, each stroke of the oar brightening the bosom of the waves with a broad silver gleam. The water that was taken up in a bucket presented the appearance of molten lead as we slowly poured it back into the sea. Everywhere over this brilliant surface of calm light myriads of dazzling green sparks and globes of fire were flashing, quivering, and dying amid the undulations of the waves' (Rambles of a Naturalist).

The luminousness thus described was known to and observed by the ancients, who also speculated as to its cause; and the phenomenon has not escaped the usual fate of similar and strange appearances in being regarded by the ignorant and superstitious as of unreal and supernatural origin.

The *animals* in which the luminous property has been observed belong to nearly every main group of the zoological series. Beginning with the Protozoa or lowest sub-kingdom of animals, we find a prominent example of a luminous form in the *Noctiluca miliaris* (which see), an organism most nearly allied to the Infusorian animalcules. This organism appears to be the chief cause of the *diffused* luminosity of the sea, these animalcules existing in immense myriads in the waters of the ocean. Other and true Infusoria appear also to possess phosphorescent properties. Among Cœlenterate forms many of the Medusæ (see MEDUSIDÆ) or Jelly-fishes are prominent in respect of their luminous qualities. The *Physaliæ*, or 'Portuguese Men-of-War;' the *Cestum Veneris*, and other Ctenophoræ; many Zoophytes; the *Pennatula phosphorea*, or luminous 'sea-pen,' &c., all exemplify phosphorescent forms belonging to the Cœlenterate group. Some Echinodermata, exemplified by certain Starfishes, are luminous. Amongst the Annulosa many Annelides or Worms (for example, certain Errantia or marine worms); certain Myriapoda (for example, Centipedes and Millepedes); some Insects, chief among which are the Fireflies (*Elater*), the Lanternflies (*Fulgora*), and the Glowworms (*Lampyris*), &c.; and certain Crustacea (*Cyclops*, *Gammarus*, &c.) exhibit luminous properties. The Mollusca contribute their share to this list, chiefly from the class Tunicata. In this class the *Salpæ*, and more particularly the compound Tunicates known as *Pyrosomæ*, are luminous. The latter name, indeed, has reference to the phosphorescent properties of the genus, which is represented by free and oceanic forms, presenting at night the appearance of moving masses of flame. Humboldt describes the beautiful appearance of the luminous Pyrosomæ, of which genus several species are known—*P. Atlanticum* of the equatorial seas, and *P. elegans* and *P. giganteum* of the Mediterranean, being familiar examples. Mr. Bennett describes the appearance produced by *P. Atlanticum* as 'a broad and extensive sheet of phosphorescence, extending from east to west as far as the eye could reach.' This was in lat. 30° s., and 27° 5′ w. long. Mr. Bennett cast his towing-net over the stern of the ship, 'which soon cleaved through the brilliant mass, the disturbance causing strong flashes of light to be emitted, and the shoal, judging from the time the vessel took in passing through the mass, may have been a mile in breadth. On taking in the towing-net it was found half-filled with *Pyrosoma Atlanticum*, which shone with a beautiful pale-greenish light.'

The *Pholas* (which see) or Piddock, a genus of Mollusca belonging to the Lamellibranchiate class—the members of which genus possess bivalve shells, like the oysters, mussels, &c., and bore into rocks by means of their shells—also exhibit luminous properties. The *Pholas Dactylus* is specially mentioned as a phosphorescent species, and other kinds of higher Mollusca present instances of analogous, though less marked, phenomena. Among the Vertebrate animals are included a few examples of luminous forms; the majority of instances of phosphorescence being thus seen to be included in the Invertebrate series, and chiefly amongst marine animals. Certain fishes undoubtedly appear to exhibit phosphorescence, gleams of light being emitted chiefly, it is said, from the abdominal or under surfaces of such forms. The sharks have thus been specially noted; but luminousness has been undoubtedly observed to accompany the movements of shoals of more common fishes, such as the herrings, coal-fish, pilchards, mackerel, &c. By some naturalists the luminous appearance observed in fishes has been supposed to depend rather on the presence of oily or fatty matters than on the possession of true phosphorescent qualities. But there appears little doubt at the same time that cases of actual phosphorescence are truly exemplified in the class of fishes. Certain species of turtles and a Surinam toad—respectively representing the Reptilia and Amphibia—are alleged to be luminous, and it is highly probable that many reptiles possess phosphorescent properties, although definite observations are still wanting to satisfactorily settle the point. Amongst the birds and quadrupeds a few detached examples of this phenomenon occur.

Regarding the *appearances* and *nature* of this animal phosphorescence a variety of information has been collected. The intensity, regularity, and colour

or hue of the light vary greatly under different circumstances, such as those connected with the temperature, and other physical and surrounding conditions of the animals emitting it. The hue of the phosphorescence emitted by *Pholas Dactylus* is thus stated to be bluish-white; in *Lampyris noctiluca*, one of the glowworms, it is greenish-blue; in *L. Italica* it is bright blue; whilst in one of the fireflies (*Elater noctilucus*) the light emitted is of a brilliant green, with spots of a golden blue. The light has been found to vary in the intensity and regularity of its emission. Some Mollusca appear to be permanently phosphorescent, as also are certain fire-flies; but the more general rule is that the luminousness is intermittent, and is produced under the influence of stimuli of various kinds. Thus, changes in temperature and other alterations of the medium in which the phosphorescent animals exist produce variations in the intensity of the luminousness. The warmer seas appear to be those in which luminosity is chiefly observed; hence, although phosphorescence is also observed in Arctic seas, we conclude that a high temperature is that best adapted for its favourable exhibition. The lowest temperature at which insects emit light under natural and ordinary circumstances is stated to be 50° Fahr. The glowworms shine most brightly in temperate regions during summer, and less brightly in autumn. Electrical disturbance of the atmosphere, such as generally precedes storms, is said to increase the brilliancy of the light emitted by marine forms, such as the Pholas, &c. And the phosphorescence of this latter mollusc is also said to be strongest in summer. The influence of sunlight during the day has been alleged to be favourable to the invigoration of the phosphorescent qualities of some insects, and the generalization thus made has been extended to include other forms. But the more reasonable explanation of this circumstance would appear to consist in the fact, that the sunlight being necessary or advantageous to the nutrition and health of the being as a whole, whatever tends to insure that health will naturally also cause its phosphorescent qualities to be present in fuller vigour. By Macartney it was remarked that luminous Medusæ sank in the water at moon-rise, and thus appeared to retreat from the lunar light.

Artificial irritation, as by being struck or after collision with other bodies, undoubtedly stimulates the emission of phosphorescence. Many luminous forms, which when at rest are perfectly dull and quiescent, sparkle brilliantly on being touched. Noises appear to act in an opposite manner upon luminous insects, and thus cause them to cease from shining. Movements on the part of phosphorescent animals, probably on account of their being due to muscular action and nervous activity, seem to intensify the light. The nervous influence, as we shall presently notice, is probably very intimately connected with the actual source and origin of the luminosity. And the sexual instincts, in the case of some insects at least, have been alleged to be intimately connected with the emission of phosphorescent light. Thus, in the glowworms the light emitted by the females has been regarded as being solely destined to guide the males, and is stated to grow less brilliant after the deposition of the eggs. But this theory is inapplicable to all cases in which luminousness is observed. Electricity applied in the form of galvanic currents passed through the water appeared to result in the intensification of the luminosity; but removal from their native sea-water to fresh water, or to other media, had the effect of soon extinguishing the phosphorescence in marine forms. Similarly, in the case of glowworms, removal from the atmosphere to a vacuum caused the phosphorescence to cease.

With regard, in the last instance, to the parts or organs in various animals which produce this luminosity, and also concerning the mode in which such organs produce the phosphorescence, little will require to be said. In some cases the source of the light appears to be distinctly localized within the bodies of the animals producing it. Thus, in some Medusæ so-called *luminous points* have been observed. In *Beröe*, one of the higher Cœlenterata, Ehrenberg says the luminosity issues from the ovaries, and in a nearly allied form from the cirri or tentacle-like filaments with which it is provided. The light of Pholas is emitted apparently from the inside of the *syphons* or breathing-tubes. (See PHOLAS.) In other forms the luminosity appears to be more diffused, and to exist generally throughout the tissues of the organism. Whilst in many marine animals a *luminous mucus* or viscid secretion, given off from their bodies, and mixing with the water, is regarded as the source of the phosphorescence. In insects the seat of the luminosity can be more accurately determined. Thus, in the female glowworm the light proceeds from the hinder abdominal segments; the fireflies are luminous in their chests, and also from their abdomens; whilst in *Scolopendra electrica*, a centipede-form, the light proceeds from the head. The intimate structure of luminous organs in insects appears to exhibit a simple conformation, and a fatty composition. Treviranus, indeed, concluded that the adipose or fat-tissue of insects was the general seat of this luminousness.

Various theories have from time to time been enunciated with regard to the mode in or through which the luminous organs in animals, whatever their nature, operate to produce the phosphorescence. By Mayer, &c., the light of the sun absorbed and re-emitted from the animal organization was held to be the source of the luminousness. Light swallowed (?) with the food, and elaborated by special organs, was the chief element in Brugnatelli's theory. Spallanzani maintained a chemical hypothesis, that the oxygen of the air formed the chief element in a supposed combustion productive of luminousness. Macaire's ideas resolved themselves into the theory that the essential luminous matter consisted of phosphorus and albumen, and that upon the more or less perfect coagulation of the latter depended the intensity or decrease of the luminosity. Darwin, Treviranus, Davy, &c., in part adopted Spallanzani's view of the combustion of oxygen; but they held that this element introduced in breathing acted upon phosphorus secreted by the luminous organs, and so produced the luminosity. Whilst a last hypothesis, supported by Todd and Macartney, held that the luminosity was solely a *vital* effect dependent upon a peculiar exhibition and modification of the *nervous system;* and that just as in ordinary cases *nerve-force* may be transformed into *motion* or into *electricity*, so in this special case it is transformed into *light*. Tiedemann's view included the phosphorus and oxygen theory of Darwin, &c.; but the former physiologist also held that the secretion of the phosphorescent elements was in itself a vital act.

Without entering into the merits of these various suggestions, it may be simply stated that the views of Todd and Macartney, which maintain the sole action of the nervous system and vital or nerve force in the production of the luminosity, are those which most satisfactorily and thoroughly meet and tally with the researches and opinions of modern physiology and zoology. And the luminosity of animals may therefore be most safely regarded as a peculiar modification of nerve-force, exerted in some instances through specialized structures (as in insects), or in other cases through the general tissues or secretions.

The absence of a distinct nervous system in such low forms, as Noctilucæ, Medusæ, &c., does not in the least militate against this theory. Since physiologists are now reconciled to the belief that nervous acts and the phenomena of correlation may be exhibited without the presence of, and entirely dissociated from demonstrable nerve-tissues. In cases where luminosity is exhibited after death, this result is simply due to the *somatic vitality* (or that of the *tissues*), being for a certain period inherent in the lifeless body. This theory, moreover, does not entirely lay aside some of the other theories or ideas already mentioned. No one may deny that every vital act, although essentially taking origin from a vital force, may yet avail itself of and be manifested through chemical or chemico-physical laws and conditions. And even if, in certain cases, actual chemical actions may be proved to occur, this discovery would not lessen the value or application of the theory; since these actions can only be exerted as part of a living organization, which is controlled by vital force and subject to vital laws.

PHOSPHORITE, a massive radiated mineral, consisting essentially of phosphate of calcium, obtained chiefly from Estremadura in Spain.

PHOSPHORUS was discovered by Brandt in 1669, though there are some reasons for believing that the alchemists of an earlier period were also acquainted with this substance. Brandt kept his process secret for some time. Kunckel, another German chemist, knowing only that Brandt had procured it from urine, entered on the investigation, and succeeded in discovering the process. Mr. Boyle, in England, also discovered it, and Godfrey Hankwitz, a man who was taught the process by Boyle, sold it for many years at a high price in London. In 1769 Ghan discovered that phosphate of lime is the basis of bones; and six years later Scheele published a process for extracting phosphorus from bones, a modification of which process is still in general use. Bone-ash contains a large amount of tricalcic phosphate, $Ca_3P_2O_8$. By treatment with sulphuric acid this salt is decomposed, insoluble calcium sulphate, and a soluble phosphate of calcium being produced; on evaporating the solution containing the phosphate to dryness it undergoes decomposition, water being driven off, while a new calcium metaphosphate, as it is termed, is produced; on adding charcoal to this residue, and strongly heating it, part of the phosphorus is set free and distils over, while another part remains behind as insoluble or bone phosphate. The various stages of the decomposition enumerated above are represented in chemical language as follows:—

(1.) Production of soluble phosphate, $Ca_3P_2O_8 + 2H_2SO_4 = 2CaSO_4 + CaH_4P_2O_8$.

(2.) Decomposition of this soluble phosphate, $CaH_4P_2O_8 = CaP_2O_6 + 2H_2O$.

(3.) Production of phosphorus, $3CaP_2O_6 + C_{10} = Ca_3P_2O_8 + 10CO + P_4$.

By examining these equations it will be seen that two-thirds only of the phosphorus of the bone-ash is obtained, at the termination of the process, in the free state.

The expulsion of the total amount of phosphorus may be brought about by mixing sand with the charcoal in the last stage of the operation, whereby a silicate of calcium is produced—thus,

$$3CaP_2O_6 + 3SiO_2 + C_{15} = 3CaSiO_3 + 15CO + P_6.$$

The distillation of the phosphorus is carried out in an earthenware retort, coated externally with a glaze of borax and fire-clay, placed in a furnace; the retort is connected with a wide copper tube which passes into a closed vessel containing water, under the surface of which the end of the tube dips; this vessel is fitted with an exit tube, which conveys the uncondensed gases to a chimney.

As bone-ash contains, on an average, from 20 to 25 per cent. of phosphorus, it follows that from 13 to 16 per cent. should be obtained by the above process; in practice, however, this amount is rarely, if ever, produced, from 10 to 13 per cent. being considered a good yield. The admixture of silica, although insuring the expulsion of the whole of the phosphorus, is not taken advantage of to any great extent, because the temperature to which the retorts must be raised is exceedingly high. The phosphorus, as obtained in the receivers, must undergo purification; it is generally mixed with carbon, silicon, and various other impurities. Pure phosphorus is obtained either by mechanical or by chemical treatment of the crude material. The former method consists in squeezing the substance through chamois leather or through porous earthenware, the latter in oxidizing the impurities (and removing them as a slag) by means of sulphuric acid and potassium dichromate. The latter method is more generally adopted. Phosphorus generally comes into the market in sticks; these are formed by running the molten substance into glass tubes surrounded by cold water, where it quickly solidifies.

Phosphorus, when pure, is an almost colourless, wax-like, transparent solid, which melts at 44° C., boils about 290° C., and has a specific gravity of about 1·8. When cooled to a low temperature phosphorus becomes hard and brittle; when broken, it exhibits a crystalline fracture; indeed it may be obtained in well-defined octahedral crystals by evaporating its solution in carbon disulphide. After phosphorus has been prepared for some time it loses its transparency, becomes white and opaque, and less dense than before. Black phosphorus is also produced under certain conditions; but the red or amorphous variety of phosphorus is the most remarkable. If ordinary phosphorus be heated to near its boiling-point in an atmosphere which is incapable of chemically acting upon it, a change is gradually brought about in the structure of the substance, the wax-like, crystalline solid being gradually transformed into a red, amorphous powder.

Ordinary phosphorus is very readily oxidized, taking fire spontaneously when exposed to air; amorphous phosphorus does not ignite until heated to 260° C.; ordinary phosphorus is soluble in carbon disulphide, amorphous phosphorus is insoluble in this reagent; ordinary phosphorus has a specific gravity of about 1·8, the specific gravity of amorphous phosphorus is about 2·2; ordinary phosphorus is extremely poisonous, amorphous phosphorus is not poisonous; notwithstanding these well-marked differences in physical characters, and even in toxicological action ordinary and amorphous phosphorus are to the chemist one and the same elementary substance.

Phosphorus very readily combines with oxygen. If a stick of the dry substance be allowed to remain in contact with air it speedily takes fire and burns, with the production of phosphoric pentoxide, P_2O_5. If this experiment be carried on in the dark a peculiar greenish light will be noticed playing around the stick of phosphorus for some time before it bursts into flame; this light (see PHOSPHORESCENCE) is produced by the slow oxidation of the phosphorus, with the production of the trioxide, P_2O_3. On account of its easy inflammability phosphorus must be kept out of contact with air; it must not be touched for any length of time with the fingers, and it must not be brought into a heated atmosphere. The greatest care is necessary on the part of any one in working with this substance.

In its chemical relationships phosphorus is allied

to nitrogen, arsenic, antimony, and bismuth; it has the power of combining with three atoms of hydrogen or other monovalent element, it is therefore a triad. The atomic weight of phosphorus is most probably 31; its vapour is sixty-two times heavier than hydrogen, not thirty-one times, as would have been the case did it obey the general rule concerning the vapour densities of the gaseous elements.

Phosphorus is used largely in the arts, especially in the manufacture of lucifer matches, which are tipped with a paste containing phosphorus and another material which readily parts with its oxygen, such as chlorate of potassium, peroxide of lead, &c. Safety-matches—that is, matches which ignite only when rubbed on a prepared surface—generally contain chlorate of potassium and sulphide of antimony made into a paste with gum, while the prepared surface contains amorphous phosphorus.

The annual production of phosphorus in Europe amounts to about 5500 cwts, involving the consumption of 66,000 cwts. of bones.

As has been already mentioned, two oxides of phosphorus may be produced by oxidizing the element in air. The first of these, *phosphorus trioxide* (P_2O_3), is best produced by burning phosphorus in a very slow current of dry air; it forms a bulky, white, amorphous sublimate, which greedily takes up water, forming *phosphorous acid*, thus, $P_2O_3 + 3H_2O = 2H_3PO_3$. This acid, which is also produced in many other ways, forms transparent, colourless crystals, which are deliquescent in the air, melt at 74° C., and dissolve in water to form a strongly acid liquid, which oxidizes to phosphoric acid on exposure to the air. Phosphorous acid is dibasic, two of its hydrogen atoms only being replaceable by metals. The general formulæ for the phosphites are therefore MH_2PO_3 and M_2HPO_3, where M represents a monovalent metal. Each or all of the three hydrogen atoms may be replaced by alcoholic radicles, giving rise to a series of ethers, the general formulæ for which are XH_2PO_3, X_2HPO_3, and X_3PO_3, where X represents a monovalent radicle, as ethyl, methyl, &c. A large number of phosphites is known.

Phosphorus pentoxide (P_2O_5) is produced as a snow-white, amorphous substance, by burning phosphorus in excess of perfectly dry air or oxygen. This substance combines very energetically with water, with a hissing noise. Three different acids are produced by this reaction, which may be written thus—

$$P_2O_5.H_2O = 2HPO_3.$$
$$P_2O_5.2H_2O = H_4P_2O_7.$$
$$P_2O_5.3H_2O = 2H_3PO_4.$$

To all of these acids the generic name of *phosphoric acid* is applied; but certain prefixes are used to distinguish them from each other:—

HPO_3	*monobasic* or *meta*-phosphoric acid.
H_3PO_4	*tribasic* or *ortho*-phosphoric acid.
$H_4P_2O_7$	*tetrabasic* or *pyro*-phosphoric acid.

The monobasic acid is produced by the action of cold water on the pentoxide; the tribasic acid is produced by the action of hot water on the same body; the tetrabasic is produced by the very gradual absorption of water by the monobasic acid. Or, starting with the most hydrated acid, namely, the tribasic, we may produce the tetrabasic by driving off part of the water, and the monobasic by driving off a further quantity of water. These reactions are made evident by the following equation:—

	Monobasic.	Tribasic.	Tetrabasic.
	$HPO_3 + H_2O =$	H_3PO_4	—
	$2HPO_3 + H_2O =$	—	$H_4P_2O_7$
and	HPO_3	$= H_3PO_4 - H_2O$	—
	$2HPO_3$	$=$ —	$H_4P_2O_7 - H_2O.$

Three classes of phosphates are therefore known, the *meta-phosphates*, represented by the formula MPO_3; the *ortho-phosphates*, represented by the formulæ MH_2PO_4, M_2HPO_4, and M_3PO_4; and the *pyro-phosphates*, represented generally by the formulæ $MH_3P_2O_7$, $M_2H_2P_2O_7$, $M_3HP_2O_7$, and $M_4P_2O_7$. Another acid of phosphorus, namely, *hypo-phosphorous*, H_3PO_2, is known; it is a monobasic acid, forming salts MH_2PO_2.

Phosphoretted hydrogen, or *phosphine* (PH_3), is a gaseous substance, which is produced by heating phosphorus with the solution of a caustic alkali, thus—

$$P_4 + 3KHO + 3H_2O = 3KH_2PO_2 + PH_3.$$

The gas inflames spontaneously on coming into contact with air, being hereby burned; thus $2PH_3 + O_3 = P_2O_5 + 3H_2O$. If, however, the gas be passed through a tube surrounded by a freezing-mixture, a small quantity of it is condensed to a liquid, and the remainder no longer takes fire on issuing into the air. The liquid in the cold tube is another hydride of phosphorus, and it is to the presence of a small quantity of this liquid in the gaseous hydride that we are to trace the spontaneous inflammability of the mixture.

A great many other compounds of phosphorus are known; thus we have two chlorides, PCl_3 and PCl_5; two or perhaps three iodides, bromides, sulphides, &c. Those which we have already described are the most generally interesting compounds of this element.

PHOSPHORUS BASES. This name is applied to a large series of bodies which contain phosphorus united with an organic radicle. The two principal members of the series, from which the others are derived, are *trimethyl phosphine* $(CH_3)_3P$, and *triethyl phosphine* $(C_2H_5)_3P$. These substances may be looked on as phosphoretted hydrogen (PH_3), in which the hydrogen is replaced by the radicles methyl and ethyl respectively.

PHOTIUS, a patriarch of Constantinople in the ninth century, born of patrician parents in that city about the year 815. His wealth and interest raised him to the highest offices of the state, whilst he enjoyed the reputation of being the most universally learned and accomplished man of his age. When he held the nominal office of captain of the guards he was sent on a diplomatic mission to Assyria (or more probably Persia), and he employed the leisure which his light duties afforded him in composing his Myriobiblion, his chief literary work. He afterwards became secretary of state under the emperor Michael III., and contracted an intimacy with the minister Bardas, uncle of the emperor. The patriarch Ignatius having drawn upon himself by his plain speaking the displeasure of the weak and profligate Michael, it was resolved to deprive him of his sacred office. An attempt was made to induce him to resign, but it failed, and the unfortunate patriarch was deposed with great indignity, imprisoned, and afterwards sent into exile. Bardas now persuaded the emperor to raise Photius to the patriarchal dignity. He was, it is true, a layman; but in the space of six days he hurried through all the stages of sacred orders, and on Christmas-day, 858, was consecrated patriarch by Gregory, bishop of Syracuse, lately deposed by the Roman pontiff. The installation was recognized by the metropolitans of the patriarchate, but was opposed by Pope Nicholas I., whom Photius soon after excommunicated. But the Emperor Michael having been murdered in 867 by Basil, who was raised to the throne, that prince immediately replaced Ignatius in his office, and banished Photius, who, however, resumed his dignity on the death of Ignatius in 878. On the accession of Leo, son of Basil, to the imperial throne in 886, Photius was again deposed, and ban-

ished to a monastery in Armenia, where he died in 891. His death might have put an end to the division he had occasioned between the Greek and Latin Churches had not the popes refused to acknowledge the priests and bishops ordained by him, and insisted upon their degradation. This unseasonable assertion of authority so exasperated the Greeks, that although all intercourse between the churches was not broken off, the schism which has ever since subsisted had taken root. It is now impossible to arrive at a correct estimate of the character of Photius; his biographers belonging to the Roman Church ascribe to him every excess of craft, violence, and perfidy; while those of the Greek Church as unstintedly eulogize him. He was an able man of the world, but not influenced by the high principles which befitted his sacred office; yet he was probably not below the average of the statesmen and prelates of that corrupt age. His chief remains are (1) the Myriobiblion above mentioned, which may be described as an extensive review of ancient Greek literature by a scholar of immense erudition and sound judgment. The number of books reviewed amounts to 280, and as many which are no longer extant are epitomized, it is scarcely possible to overestimate the value of Photius' work. Among the most recent editions is that of Bekker (two vols. 4to, Berlin, 1825). (2.) Nomocanon, a collection of the canons of the councils, and canonical epistles and the imperial laws concerning ecclesiastical matters. This work was printed in Greek and Latin, with commentaries by Balsamon, in Paris (4to, 1615). (3.) A Greek Lexicon, which has been printed from the MSS. of Porson under the superintendence of Dobree (two vols. 8vo, London, 1822). (4.) A collection of letters, many of them extremely interesting and elegant in style, edited by Richard Montagu (Greek and Latin, folio, London, 1651). (5.) A treatise, Adversus Latinos de Processione Spiritus Sancti, in which the writer upholds the doctrine that the Holy Spirit proceeds from the Father only; together with several other theological and controversial works. Photius' works have been collected and published in a complete form in Migne's Patrologiæ Cursus Completus (four vols. royal 8vo).

PHOTOGRAPHY (Greek, *phōs*, light, and *graphō*, I write) is the art of taking representations of objects by the action of light through the lenses of the camera obscura on a previously prepared surface. It is of comparatively recent origin, though, as early as the commencement of the present century, Mr. Thomas Wedgewood had discovered a method of copying paintings on glass, by placing beneath them a sheet of white paper or white leather covered with a solution of nitrate of silver, and thus exposed to the action of the solar light. The light penetrating through the glass produced on the paper or leather brown and black tints, varying in intensity according to the shades of the picture, and presenting the deepest hue where the light was transmitted unaltered. Mr. Wedgewood also succeeded in obtaining profiles of figures by throwing their shadows on this prepared paper, but found himself unable to *fix* the pictures, that is, to prevent the light or white parts from subsequently becoming darkened by exposure to the light. About 1814 M. Nicéphore Niepce in France discovered a method of producing, by means of the camera obscura, pictures on plates of copper coated with silver, and at the same time of rendering them permanent. To this art he gave the name of *heliography*, from *helios*, the sun, to the agency of whose light the pictures owed their origin. In the course of a few years M. Niepce formed a connection with M. Daguerre, who had also been employing himself in the same kind of experiments, and a deed of copartnery was entered into between them in 1829. M. Niepce died in 1833, and a fresh copartnery was formed between his son and M. Daguerre, who having in the course of his researches discovered an entirely new process from that invented by the elder Niepce, was allowed by this agreement to claim it as his own, and call it by his own name. Such is the history of the *daguerreotype*, which was first given to the world in 1839, and soon became famous over Europe. In the meantime, however, Mr. Henry Fox Talbot had discovered, without any knowledge of the previous labours of Mr. Wedgewood, the process of obtaining pictures in the camera by the agency of light on paper washed with nitrate of silver, and also of fixing them when so obtained. Mr. Talbot gave the name of *calotype* to his process (from *kalos*, fair, and *tupos* or *typos*, an impression), and subsequently introduced various improvements on it, and took out several patents, the earliest being in 1841. It has also been called after him *talbotype*, in the same manner as *daguerreotype* from Daguerre. Numerous modifications of the calotype have been introduced of late years, besides various new photographic processes, the most important being those of M. Niepce de St. Victor and Mr. Scott Archer, the former of whom introduced the use of albumen and the latter that of collodion as a substitute for paper, these substances being in either case spread over a plate of glass. It would be impossible to give here a detailed account of the different photographic processes, which are both numerous and continually receiving modifications and improvements. We shall, therefore, only present the reader with a description of three of the principal and best-known styles, the daguerreotype, the calotype or talbotype, and the collodion processes.

In daguerreotype pictures a plate of copper, coated with silver, and highly polished by means of animal charcoal and spirits of wine, or tripoli and essential oil of lavender, is rendered sensitive to light by being placed in a box, the bottom of which is strewed with iodine, covered with a little sand or a card. This gives a fine straw colour to the plate, which is then, to accelerate still further the action of light, exposed to the vapour of bromine till it attains a rose colour, a thin film of iodo-bromide of silver being thus produced. It is then placed in the camera for a period, varying according to circumstances from a second to a few minutes, and having thus received an impression of the object desired to be represented is removed to a box, where the picture is developed by placing the plate a few inches above a small pan of mercury. A spirit lamp is placed beneath, and by the application of heat the mercury rises in vapour, which decomposes those parts of the film which have been exposed to the light, forming thereby an amalgam with the silver: as the thickness of this amalgam varies with the intensity and duration of the action of light, different shades corresponding to the lights and shadows of the object become apparent in the picture. The process of development is watched by the light of a candle through a pane of yellow glass in the side of the box, and when completed the picture is fixed by immersing it in a solution of hyposulphite of sodium, and then washing it with water, whereby the undecomposed iodo-bromide of silver is removed. A solution of salt of gold is then poured over it, and the plate held over a spirit lamp till the gold produced by the reduction of its salt is burned in, after which it is washed and dried, and the picture is finished. In sharpness and delicacy of detail the daguerreotype excels all other photographic pictures, but is very troublesome to complete successfully, and is besides liable to fade soon, from the tendency of mercury and silver to combine with oxygen. It has, accordingly, in a great measure been superseded by other processes.

In the calotype or talbotype process a sheet of writing paper is washed on one side with a solution of nitrate of silver, applied by a soft camel-hair brush, and when dry immersed in a solution of iodide of potassium, then dipped in water, and finally dried. The paper should now be kept excluded from the light till required for use. To make it sensitive to the action of light it is washed with a mixture of two chemical solutions, one of nitrate of silver, with the addition of acetic acid; the other of crystallized gallic acid. This mixture, called *gallo-nitrate of silver*, is spread with a brush on the nitrated side of the iodized paper, which, after having absorbed the solution, is dipped in distilled water and then dried, first with blotting-paper, and afterwards by heat. It is now ready for receiving the impression of the object in the camera, after which it is taken to a dark room where the picture is developed by brushing it over with the gallo-nitrate of silver. It is then dipped in water, partly dried by blotting-paper, and fixed by washing it with a solution of hyposulphite of sodium, which dissolves the whole of the iodide of silver unacted upon by the light. The picture thus obtained is a *negative*, that is, with the lights dark and the shadows white, contrary to the natural appearance of the object. To produce a *positive* picture, where the lights and shadows shall appear as in nature, the negative is placed on the sensitive surface of another sheet of prepared paper, and a piece of glass pressed on both to insure contact. The sunlight penetrates the negative, and darkens the parts of the underlying paper opposite the lights of the picture, whilst the parts opposite the shadows, or opaque parts of the latter, are protected. This process for obtaining a positive picture from a negative is called *printing*.

The use of collodion in photography was first suggested by M. le Gray, and introduced by Mr. Archer in 1850. The ease with which this process may be conducted has led to its universal adoption, and the photographic art has in consequence been greatly extended, and become more generally practised among the public at large. Collodion is a fluid made by dissolving gun-cotton in a mixture of sulphuric ether and alcohol; and when used for photographic purposes is mixed with a solution of iodide of potassium or iodide of ammonia in alcohol. Glass is the substance on which pictures are taken by the collodion process. The plate being first scrupulously cleaned from stains and grease, the collodion is poured over it so as to cover the whole surface; the superfluous fluid is then drained off so as to leave a solid film, and the plate is excited or made sensitive by the formation upon it of a small quantity of iodide of silver, brought about by immersing it in a bath, composed of nitrate of silver, iodide of potassium, alcohol, and distilled water in certain proportions. After remaining there from two to four minutes it is removed, and while still in a wet state placed in the camera, where it remains for a number of seconds, varying according to circumstances. The picture is now developed by pouring over it a solution composed of pyrogallic acid, distilled water, glacial acetic acid, and alcohol, with the addition of a few drops of a solution of nitrate of silver; this solution absorbs oxygen, and so, in the presence of silver nitrate, tends to reduce the iodide of silver to the metallic state. The solution is then poured off, and the surface of the plate washed with water. To fix the picture a solution of hyposulphite of sodium is poured over it, and afterwards washed away by pouring water copiously over the plate, which is lastly varnished by spirit varnish, or by a solution of amber in chloroform. A negative picture is thus produced, from which a positive may be obtained in the same manner as that described above in the calotype process. Positive pictures may, however, be obtained on glass directly without the necessity of printing, by pouring over the plate, when taken from the camera, a solution of protosulphate or protonitrate of iron and nitric acid. After a negative picture has thus been developed, a mixture of pyrogallic acid and hyposulphite of soda is poured over it, and the plate slightly warmed, when the dark parts will become of a bright white by the formation of metallic silver, brought about by the reducing action of the iron salt and nitric acid. The picture is then placed in a frame, with a lining of black cloth or velvet to produce the shadows. Photographers frequently cover the back of the glass plate with a black varnish, instead of using the inner back of the case; but the effect is to reverse the position of the objects in the picture, making the right side appear left, and the left side right. This may be obviated by applying the black varnish to the *face* instead of the *back* of the picture, which is then viewed through the reverse side.

The action of light on the haloid salts is a subject which has not yet been fully investigated. From the most recent researches it would appear that a subsalt is first of all produced by the action of the solar rays upon chloride or bromide of silver, and that after a time the salt is further reduced, with the formation, probably, of metallic silver. The different silver haloid salts possess different degrees of sensibility to the chemical action of light, varying with the amount of the halogen (chlorine or bromine) present; thus, if the sensibility of the chloride be taken as 1, that of the bromide is 2·396, while the number representing the sensibility of the iodo-bromide is 4·06. The rays of the spectrum have not all the same photochemical power; the violet and ultra-violet rays bring about chemical decomposition more energetically than the red or yellow rays. Upon different substances the same ray has not, however, the same photo-chemical effect: the maximum photographic action being, as a general rule, obtained by exposure to those rays which the particular substance under examination has the power of absorbing. The admixture of certain chemically inactive substances, which have the power of absorbing rays not absorbed by the substance itself, may altogether alter the position of maximum effect: thus, if aurine—a yellowish-red colouring matter—be added to silver bromide, the mixture is energetically acted upon by the indigo rays, as is also the case with the pure bromide, and also by the yellow rays which have little or no action on the bromide alone.

To transfer the picture obtained in the camera to a suitable printing surface, so that faithful impressions may be produced with rapidity, and, above all, at a moderate cost, is a problem which has for many years occupied the attention of photographers. In 1839 Mr. Mungo Ponton discovered that paper impregnated with a solution of bichromate of potash became highly sensitive to light, and that by exposing it under a negative in the usual way a picture could be obtained, which was revealed and fixed by simply washing away the soluble bichromate unacted upon under the dark portions of the negative, the portions acted upon by light through the transparent parts being rendered insoluble thereby. M. Becquerel, and subsequently Mr. Fox Talbot, added to our knowledge of the action of chromic salts upon organic matter. In 1855 M. Poitevin devised a process by which pictures of great beauty and permanence were obtained. He combined carbon or any other pigment, in a fine state of division, with gelatine, starch, or gum, applied it over the surface of his paper, dried it, submitted it to the action of light under a photographic nega-

tive, and so first produced what is now usually called a carbon print. The results were only satisfactory whenever the negative was that of a subject in line or stipple; but when the negative was one taken from a natural object the process was unequal to the task of reproducing the beautiful gradation and half tone which we see in a good photograph. In 1856 the Duc de Luynes founded a prize of 8000 francs, to be given to the artist who should discover a process by which pictures could be produced containing all the gradation of light and shade found in a good photograph combined with the permanence of a printed book. He also gave 2000 francs to be divided among those who, up to a certain time, had approached nearest to the desired end; and out of this fund a medal of 400 francs was given to Mr. Pouncey, of Dorchester, for his carbon process, which is described by its inventor as follows: The sensitive medium used is bitumen of Judæa dissolved in turpentine, benzol, or other hydrocarbon, with which is ground up oil-colour of any desired tint. The pasty mass is then brushed over a thin sheet of translucent paper, and dried in the dark. When dried, the sheet is exposed under a photographic negative to daylight, or to a strongly actinic artificial light, which renders insoluble those parts of the sensitized pigments to which the transparent parts of the negative have permitted access of light. After some minutes' exposure to light the embryo picture is washed in turpentine, benzol, or any other solvent of bitumen. This dissolves those portions which have not been affected by the actinic rays, leaving the remainder of the pigment firmly attached to the paper in quantity proportional to the amount of light which permeated the different parts of the negative. The picture is now complete, and may be transferred, as in the lithographic process, to card-board, canvas, wood, stone, &c.; or if ceramic colours are used, it may be transferred to potters' biscuit, and burned in as usual. In 1864 carbon-printing was brought to a high state of perfection by Mr. Swan of Newcastle. He first prepares a tissue by forming a layer of gelatine and sugar mixed with a due proportion of pigment, and which he calls the tissue compound, upon paper. This compound may be mixed at once with the bichromate or sensitizer, and applied with it to the paper, in which case sensitized tissue is at once formed, which has only to be dried to be ready for use. The tissue is exposed to light under the negative with its sensitive surface in contact with the glass. After exposing for a short time, the surface of the tissue is cemented to a piece of paper, which is called the support, the picture formed on the surface of the sensitive tissue being thereby transferred to, and supported by, the second sheet of paper. This may either be permanent or temporary; if the latter, the best cement is a solution of caoutchouc in benzol. The picture with the surplus tissue unacted upon by light is now inclosed between the layers of paper, one only of which is permeable to water. On immersing the whole in this fluid slightly heated the soluble part of the compound softens and partially dissolves, and the doubled sheet splits into two portions, one taking with it the soluble tissue compound, while the other retains the insoluble portion which constitutes the picture formed by light, and which is rendered perfect by simply washing in warm water. It is, however, reversed, and must be transferred to another sheet of paper, which then becomes the final support. Gelatine, rendered insoluble by chrome alum, is usually employed as the cement in this case; and when the picture has been thus treated, it is again put between two sheets of paper. The temporary support is easily removed by spreading on its back a little benzol, and the picture is then ready to be trimmed and mounted. Among the latest and most important discoveries in connection with photographic printing is that of Mr. Walter Woodbury. The first step in the process is the exposure, in a solar camera, of the negative, which is taken in the ordinary manner, in contact with a film of bichromatized gelatine supported on a plate of talc. By this operation the parts acted upon by the light are rendered insoluble; a stream of hot water removes all the soluble portion of the film, leaving a faithful transcript of the negative in relief. A cast, or *cliché*, as it is technically called, of the gelatine film is then taken in soft type-metal by means of a hydraulic press. This cliché forms the printing-surface. The ink is a solution of gelatine mixed with any suitable colouring matter; it is poured hot upon the surface of the plate, upon which a piece of paper is then placed. A gentle pressure is applied, and maintained sufficiently long to allow the gelatine to set. The gelatine film adheres to the paper, and forms the picture. It will thus be seen that the shades of the picture are produced by the varying thickness of the gelatine—that the picture is, in fact, a cast of the metal cliché, but so thin that when the print is dry it is impossible to see, or even to feel, that it is in relief. By using an ink of the ordinary photographic tone, it is with great difficulty that pictures thus obtained can be distinguished from photographic prints. About 200 prints per hour can be produced by one man working three presses simultaneously. Beautiful effects are obtained by taking impressions on opal-glass instead of paper. It is found that caoutchouc, like bitumen of Judæa and some other hydrocarbons, is capable of receiving a photographic impression; and a thin film of caoutchouc dissolved in benzol is spread upon paper, which is exposed in the camera in the usual manner. The portions which have been subjected to the action of the light are rendered insoluble, and the other portions are then washed away as in Pouncey's process. The caoutchouc, wherever it remains on the paper, will receive a greasy ink from a roller which is now passed over the damped sheet, and the impression thus obtained may be transferred to the lithographic process. By the platinotype process permanent prints on paper are obtained. A sheet of paper is coated with a solution of platinum chloride and iron oxalate. After the paper has been dried and exposed under a negative a faint image is perceived. This image develops into a rich black by immersing the print in a solution of oxalate of potash heated to 170° Fahr. An acid water bath is all that is required to fix the image. Photo-engraving has not been brought to the same stage of perfection as printing by the above processes. We can only give one or two of the methods. 1. The photographic image is first impressed upon a sensitized sheet of gelatine, which is then dipped in a solution of alum, and when dry and hard the film is pressed down with great force upon a steel plate and leaves an indentation of the photographic picture, which may be printed from in the manner of ordinary steel engravings. 2. A pure silver surface is exposed to the action of iodine, and a film of iodide of silver is thus obtained. The plate is then exposed in the camera, and is next submitted to the action of an electrotype battery. The copper only attaches itself to those portions of the plate which have been rendered conductors of electricity by the action of the light, and a well-defined image in copper is thus obtained. The plate is next dried, and etching solution poured over it, composed of sulphuric acid and nitrate of potash. This attacks the shadows or exposed portions of the silver plate, leaving the copper parts unaffected. After etching to the necessary depth, the copper is removed by aqua regia, leaving

a finely etched image on the silver plate. It is advantageous, in this process, to gild the copper before pouring on the etching liquid, as its action on the protuberant parts would thus be better resisted. *Photozincography*, a process invented by M. Toowey, and brought to a great state of perfection by Sir Henry James, director of the ordnance survey of Great Britain, is very advantageous for reproducing anything in line. The chemical agents used in the preparation of the zinc plate are bichromate of potash and gelatine. The government maps produced by this process cost the exchequer fully £50,000 less than they would have done by any other suitable process. Copies of deeds or drawings can be produced by it cheaper than by hand, and of course with much more accuracy.

The advantages of photography are becoming daily more manifest, whether we consider it in an artistic, social, or educational point of view. Its widest and most popular range of usefulness is in the production of portraits and the depicting of landscapes and natural scenes. Copies of the most celebrated works of art, whether in painting or sculpture, may now be multiplied indefinitely; and in the case of statuary, when taken binocularly and viewed through the stereoscope, may be studied as if the originals were present. In all departments of science this art has become an important auxiliary; the zoologist, the botanist, the astronomer, the architect, and the engineer find its aid invaluable. Viewed either as a branch of the fine arts, or a medium for furthering the cause of science and education, photography must be regarded as one of the most beautiful and useful inventions of the present century.

PHOTOMETER, an instrument intended to indicate relative quantities of light, as in a cloudy or bright day, or to enable two light-giving bodies to be compared. The photometer in general use was invented by Bunsen; it consists of a screen of thin paper moistened with a solution of spermaceti in turpentine, except a spot in the centre. This screen being placed on a stand at a fixed distance from a source of light of constant intensity, the ungreased spot appears darker than the greased part. One of the lights to be compared is then placed in front of the screen, and adjusted at a distance such that the ungreased spot is illuminated as much as the rest of the screen. A similar experiment being made with the other light to be compared, the intensities of the two are to one another in the proportion of the squares of the distances from the screen at which the lights must be placed in order to cause the disappearance of the ungreased spot.

PHOTOPHONE, an instrument invented in 1880 by Prof. Graham Bell, which resembles the telephone except that it transmits sounds by means of a beam of light instead of the connecting wire of the telephone. The success of the instrument depends upon a peculiar property of the rare metal selenium, that, namely, of offering more or less opposition to the passage of electricity according as it is acted upon or not by light. In its simplest form the apparatus consists at the receiving end of a plane mirror of some flexible material (such as silvered mica) upon which a beam of light is concentrated, and the voice of a speaker directed against the back of this mirror throws the beam of light reflected from its surface into undulations which are received on a parabolic reflector at the other end, and are centred on a sensitive selenium cell in connection with a telephone, which reproduces in articulate speech the undulations set up in the beam of light by the voice of the speaker. For the beam of light employed the sun is obviously the best source, but artificial light is also available, the oxy-hydrogen lamp having proved almost equally effective. It is not yet certain to what distance the human voice may be thus transmitted, but it is believed that the instrument will be utilized in circumstances such as those in which the heliograph has been found useful; in enabling, for instance, communications to be carried on between bodies of troops at some distance from each other or between the shore and vessels at sea.

PHRASE. See MUSIC.

PHRENOLOGY (Greek, *phrēn*, mind, and *logos*, discourse), the term applied to a science, or what lays claim to be a science, of recent origin, which affects to be a philosophy of mind founded upon the physiology of the brain. It was long ago observed by physiologists that in animals a certain character and intelligence seemed to accompany a certain formation and size of skull. Lavater, in his system of physiognomy, went further than this, and gave to particular shapes of the head certain powers and passions: the conical head he terms *religious;* the narrow retreating front, *weak-minded;* the broad neck, *salacious;* &c. But it was reserved to Drs. Gall and Spurzheim to expand this germ of doctrine into a minute system, and to map out the whole cranium into small sections, each section being the dwelling-place of a certain faculty, propensity, or sentiment, in all amounting to thirty-five, a number which by no means can be supposed to include all the conceivable faculties, propensities, or sentiments that may be alleged as belonging to man, but which we may imagine they were obliged to restrict themselves to for want of room.

Dr. Gall has the honour of first starting this so-called science; but to Dr. Spurzheim it is mainly indebted for its systematic arrangement, and to Dr. Combe of Edinburgh for its advocacy. Dr. Gall tells us that when a school-boy he could not help noticing that boys with large and prominent eyes were remarkable for the excellence of their memory, and that this led him to conceive that since memory has its external sign, the other faculties might very well have theirs, and caused him to pay particular attention to the shape of the head of every person remarkable for any talent or for any quality. By degrees he came to think he could perceive one constant shape in the head of every great painter, of every great musician, of every great mechanic, severally denoting a decided predisposition in the individual to one or other of these arts, and was thus led to suspect that the form of the skull is entirely due to the form of the organ which is contained in it. 'From that instant,' he says, 'I conceived the hope of being able one day to determine the moral and intellectual faculties of man by means of his cerebral organization, and of establishing a physiology of the brain. I therefore resolved to continue my researches until I should obtain my object or find it impossible. The task would have been less difficult had I abandoned myself entirely to nature. But I had learned too much of the errors and prejudices then taught upon those subjects not to be biassed by them, and I was still further entangled by the doctrines of metaphysicians, who teach that all our ideas come by our senses; that all men are born alike; that education and accident alone make them differ. If this be true, said I, no faculty can have an external sign, and to study the brain, its parts, and its functions is absolute madness. Still I remembered my former observations; I knew that the circumstances in which my brothers and sisters, my school-fellows and my playmates, had from their infancy been placed were all alike. I saw that education was bestowed in vain on some persons, that others had talents without it. I observed a proportionate variety in the dispositions of animals. Some dogs are born hunters, while others of the same

litter cannot be taught; some are peaceful, some ill-tempered. In birds there is a similar diversity. The whole animal kingdom spoke then in favour of my strong surmises, and I resolved to prosecute my plan.'

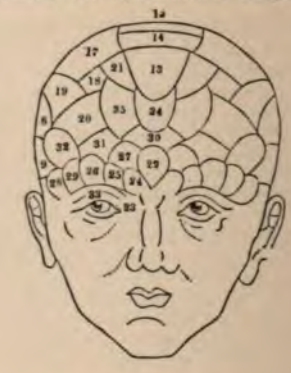
Dr. Gall, from whom the above quotation is borrowed, commenced giving private lectures on the subject in 1796, but at the end of five years the Austrian government took alarm at his novel doctrines, and prohibited his lectures unless under a special permission. The prohibition of course stimulated curiosity, and added to the notoriety of the science. In 1800 he was joined by Dr. Spurzheim, who continued his colleague till 1813, both conducting their researches in common. They travelled together from place to place, visiting prisons and examining felons of every description, for the purpose of extending or confirming their theories, and lecturing occasionally, with the view of indemnifying expenses or gaining proselytes. Their great trial was at the bar of the French Institute, Paris, where they presented themselves to receive official support or condemnation of their science. A commission was named by the Institute to report upon the labours of Drs. Gall and Spurzheim. After much patient investigation the report was drawn up by the celebrated Cuvier. It was unfavourable to the science of phrenology, and even *went so far as to excuse the Institute for having taken the subject into consideration at all.*

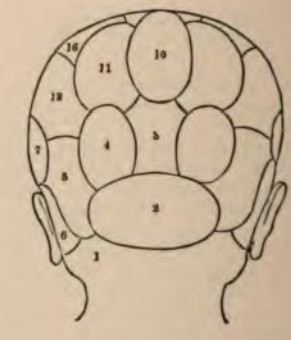
In March, 1814, Dr. Spurzheim came to Britain, and proceeded to London, where he exhibited at the Medico-Chirurgical Society's hall, commencing by a dissection of the brain. He delivered a course of lectures, but his auditors were not more than forty, and his second course was equally thinly attended. At Bath, Bristol, Dublin, and Cork, where he also delivered lectures, he was equally coldly received; but at Edinburgh he was more successful in procuring proselytes. Attention had been drawn to the subject there by a very pungent article against phrenology in the Edinburgh Review for June, 1815, which so far favoured Dr. Spurzheim as to raise curiosity about him, and fill his class-room. He remained in Edinburgh seven months, and was so successful in gaining converts that he predicted it to be the spot from which, as from a centre, the doctrines of phrenology should spread over Britain. His prediction has been thus far verified, that Edinburgh soon became the very head-quarters of phrenology, and has long possessed a flourishing Phrenological Society, with a museum. The founder also of this society, George Combe, must be allowed to have been one of the best expounders and defenders of phrenology which the science yet can boast.

Dr. Spurzheim returned to London, thence to Paris, and did not visit Britain again till 1825. Societies with collections of busts had by this time been established in almost every considerable town in the empire; and such was the mania of the day, that the doctor was warmly received wherever he went—at London, Liverpool, Manchester, Hull, Exeter, Dublin, Cork, Glasgow, Paisley, Dundee, &c. Dr. Spurzheim eventually went to America, where he died in 1832.

Although Dr. Gall was the founder of phrenology, and although he was the discoverer of twenty-seven organs out of thirty-five, he is generally admitted to have been deficient in forming a system, or in deducing from it philosophical data. Dr. Spurzheim is said by phrenologists to have contributed most to the advancement of the science, by enriching it with important discoveries, by arranging it into a system, and by showing how it might be applied to many interesting purposes connected with the human mind. We shall here give a list of the twenty-seven organs discovered by Dr. Gall, with the titles he affixed to each. These titles, it will be observed, differ chiefly from those of Dr. Spurzheim in being less comprehensive in their character, and therefore less pliable in representing the various faculties and dispositions of man. For example, what Gall called *murder*, Spurzheim calls *destructiveness*, thus including in it a desire to destroy noxious animals, and to kill for food; and while Gall has a bump for *veneration* and one for *religion*, Spurzheim confines himself to *veneration*, saying it includes not only a propensity to venerate God, but to venerate wealth, power, or any distinguished personage.

The following is Dr. Gall's list:—No. 1, the instinct of veneration. No. 2, the love of offspring. No. 3,





friendship. No. 4, courage, self-defence. No. 5, murder. No. 6, cunning. No. 7, the sentiment of property. No. 8, pride, self-esteem, haughtiness. No. 9, vanity, ambition. No. 10, cautiousness. No. 11, the memory of things, the power of being educated. No. 12, local memory. No. 13, the memory of persons. No. 14, verbal memory. No. 15, memory

for languages. No. 16, colours. No. 17, music. No. 18, number. No. 19, aptitude for the mechanical arts. No. 20, aptitude for drawing comparisons. No. 21, aptitude for drawing conclusions. No. 22, wit. No. 23, poetry. No. 24, good-nature. No. 25, mimicry. No. 26, religion. No. 27, firmness of character. The figures in this list have no relation to those on the casts.

Dr. Spurzheim's arrangement of the faculties is comprised in orders, genera, &c. We subjoin a phrenological chart, together with Dr. Spurzheim's list of the organs, taken from Combe's Elements of Phrenology.

Order I.—FEELINGS.

Genus I.—Propensities—*common to Man with the Lower Animals.*

1. Amativeness—Produces sexual love.
2. Philoprogenitiveness.—*Uses:* Love of offspring.—*Abuses:* Pampering and spoiling children.
3. Concentrativeness.—*Uses:* It gives the desire for permanence in place, and for permanence of emotions and ideas in the mind.—*Abuses:* Aversion to move abroad; morbid dwelling on internal emotions and ideas, to the neglect of external impressions.
4. Adhesiveness.—*Uses:* Attachment; friendship and society result from it.—*Abuses:* union for improper objects, attachment to worthless individuals. It is generally strong in women.
5. Combativeness.—*Uses:* Courage to meet danger, to overcome difficulties, and to resist attacks.—*Abuses:* Love of contention, and tendency to provoke and assault. This feeling obviously adapts man to a world in which danger and difficulty abound.
6. Destructiveness.—*Uses:* Desire to destroy noxious objects, and to kill for food. It is very discernible in carnivorous animals.—*Abuses:* Cruelty, desire to torment, tendency to passion, rage, harshness and severity in speech and writing. This feeling places man in harmony with death and destruction, which are woven into the system of sublunary creation.

6a. Alimentativeness, or appetite for food.—*Uses:* Nutrition.—*Abuses:* Gluttony and drunkenness. This organ is considered only probable, and is not marked on the chart; it is situated between Nos. 6 and 9.

Love of Life is a conjectural propensity, also left unmarked. Combe suggests that this organ is probably a convolution at the base of the middle lobe of the brain, the size of which cannot be ascertained during life.

7. Secretiveness.—*Uses:* Tendency to restrain within the mind the various emotions and ideas that involuntarily present themselves, until the judgment has approved of giving them utterance; it is simply the propensity to conceal, and is an ingredient in prudence.—*Abuses:* Cunning, deceit, duplicity, lying, and, joined with acquisitiveness, theft.
8. Acquisitiveness.—*Uses:* Desire to possess, and tendency to accumulate articles of utility, to provide against want.—*Abuses:* Inordinate desire for property; selfishness; avarice.
9. Constructiveness.—*Uses:* Desire to build and construct works of art.—*Abuses:* Construction of engines to injure or destroy, and fabrication of objects to deceive mankind.

Genus II.—Sentiments.

I. *Sentiments common to Man with the Lower Animals.*

10. Self-esteem.—*Uses:* Self-respect, self-interest, love of independence, personal dignity.—*Abuses:* Pride, disdain, overweening conceit, excessive selfishness, love of dominion.
11. Love of Approbation.—*Uses:* Desire of the esteem of others, love of praise, desire of fame or glory.—*Abuses:* Vanity, ambition, thirst for praise independently of praiseworthiness.
12. Cautiousness.—*Uses:* It gives origin to the sentiment of fear, the desire to shun danger, to circumspection; and it is an ingredient in prudence.—*Abuses:* Excessive timidity, poltroonery, unfounded apprehensions, despondency, melancholy.
13. Benevolence.—*Uses:* Desire of the happiness of others.—*Abuses:* Profusion, injurious indulgence of the appetites and fancies of others, prodigality, facility of temper.

II. *Sentiments proper to Man.*

14. Veneration.—*Uses:* Tendency to worship, adore, venerate, or respect whatever is great and good; gives origin to the religious sentiment.—*Abuses:* Senseless respect for unworthy objects consecrated by time or situation, love of antiquated customs, abject subserviency to persons in authority, superstition.
15. Firmness.—*Uses:* Determination, perseverance, steadiness of purpose.—*Abuses:* Stubbornness, infatuation, tenacity in evil.
16. Conscientiousness.—*Uses:* It gives origin to the sentiment of justice, or respect for the rights of others, openness to conviction, the love of truth.—*Abuses:* Scrupulous adherence to noxious principles when ignorantly embraced, excessive refinement in the views of duty and obligation, excess in remorse, or self condemnation.
17. Hope.—*Uses:* Tendency to expect and to look forward to the future with confidence and reliance; it cherishes faith.—*Abuses:* Credulity, absurd expectations of felicity not founded on reason.
18. Wonder.—*Uses:* The desire of novelty, admiration of the new, the unexpected, the grand, the wonderful, and extraordinary.—*Abuses:* Love of the marvellous, astonishment.—*Note.* Veneration, hope, and wonder combined give the tendency to religion; their abuses produce superstition and belief in false miracles, in prodigies, magic, ghosts, and all supernatural absurdities.
19. Ideality.—*Uses:* Love of the beautiful and splendid, the desire of excellence, poetic feeling.—*Abuses:* Extravagance and absurd enthusiasm, preference of the showy and glaring to the solid and useful, a tendency to dwell in the regions of fancy, and to neglect the duties of life.
20. Wit—Gives the feeling of the ludicrous.
21. Imitation—Copies the manners, gestures, and actions of others, and nature generally.

Order II.—INTELLECTUAL FACULTIES.

Genus I.—External Senses.

Feeling or Touch. Taste. Smell. Hearing. Sight.	*Uses:* To bring man into communication with external objects, and to enable him to enjoy them.—*Abuses:* Excessive indulgence in the pleasures arising from the senses, to the extent of impairing the organs and debilitating the mind.

Genus II.—Intellectual Faculties—*which perceive existence.*

22. Individuality—Takes cognizance of existence and simple facts.
23. Form—Renders man observant of form.
24. Size—Renders man observant of dimensions, and aids perspective.
25. Weight—Communicates the perception of momentum, weight, resistance, and aids equilibrium.
26. Colouring—Gives perception of colours.

Genus III.—Intellectual Faculties—*which perceive the relations of external objects.*

27. Locality—Gives the idea of space and relative position.
28. Number—Gives the talent for calculation.
29. Order—Communicates the love of physical arrangement.
30. Eventuality—Takes cognizance of occurrences and events.
31. Time—Gives rise to the perception of duration.
32. Tune.—The sense of melody arises from it.
33. Language—Gives a facility in acquiring a knowledge of arbitrary signs to express thoughts, readiness in the use of them, and a power of inventing them.

Genus IV.—Reflecting Faculties—*which compare, judge, and discriminate.*

34. Comparison—Gives the power of discovering analogies, resemblances, and differences.
35. Causality—Traces the dependences of phenomena, and the relation of cause and effect.

The reader must be apprised that most of the organs enumerated above have duplicates, that is, the one hemisphere of the brain is said to resemble exactly the other. This is inferred from analogy. We have two eyes and two ears, say phrenologists; so we have two organs of wit, destructiveness, &c. In those organs, however, that are situated along the middle line of the head, the two hemispheres of the brain approach so closely that both the organs are included in one circle; but still phrenologists insist on two organs, one on each side. The advantage of possessing duplicate organs is this. It has often been objected to phrenology, that people are frequently injured on particular parts of the cranium—indeed, there are many cases not fatal in which portions of the brain have been actually destroyed—and yet the faculty attributed by phrenologists to the injured locality has not been in the slightest degree impaired. A soldier on the field of battle, as has been wittily observed, whose organ of Veneration receives a blow, is never heard to exclaim, 'There! my religion is clean gone! I care nothing *now* for God or the captain!' A tender father wounded on the organ of Philoprogenitiveness feels no sudden disregard for his children. A miser well banged on the organ of Acquisitiveness does not instantly become careless of his money bags; nor is a coward, whose large bump of cautiousness has been half beaten in by ruffians, in any degree cured of his timidity. To such facts as these phrenologists say the brain is composed of two similar halves or hemispheres, and the organs of all the faculties are double. That one eye, one ear, or one nostril may perform its functions, and the person see, hear, or smell, although the eye, ear, and nostril of the opposite is diseased or injured, is a fact of which we all are aware. Now, as the organs of the mental faculties are double, analogy would lead us to conclude that such will also be the case with them; and that before we can expect complete loss of any one faculty the entire organ of each side must be destroyed, just as both eyes or both ears must be diseased before complete loss of sight or hearing occurs. But this reasoning is by no means satisfactory. For even granting the hypothesis, and not to insist on the position that it is necessary to produce something more than bare assertion for the duplicate existence of the organs before we admit their illustration as available in argument, we may say, that when a man loses his eye he feels its want, and if he becomes deaf on one side he is quite conscious of a defect in hearing. A similar consciousness, by analogy, should accompany the destruction of one of a pair of phrenological organs. The wounded soldier should at least become by one-half less ardent in his devotions, and the wounded miser take a much less firm grasp of his money-bags. But neither the consciousness of defect nor the fact of defect accompanies the injury. Besides, it so happens, as we have already said, there is a range of faculties at the conjunction of the hemispheres of the brain, the organs of which, though called double, are quite contiguous, and therefore substantially single, so that *it is impossible to injure one without injuring both*. These organs comprehend Comparison, Benevolence, Veneration, Firmness, &c., all of which, being situated on the front, top, and centre of the head, are more open to injury than any others.

Were phrenology an established science, and were it possible to draw unerring deductions from the data which it lays down, it cannot be denied that its discovery would be the greatest step ever made in mental philosophy, and its application the most beneficial ever used for the amelioration of the human race. It would give man a knowledge of himself, and direct him in the application of the faculties with which he might be endowed. By disclosing individual character it would give security to social intercourse, and make communication prompt and easy. It would disclose real merit and expose unworthiness. The truly wise and good would at last attain their proper station in society; while the ignorant and vicious would be obliged to hide their diminished heads. To parents the science would be of invaluable service, in directing them as to the proper moral and intellectual training of their children; nor would any difficulty longer exist regarding the choice of a profession—no one, in future, would be made a lawyer who should have been a painter, nor a clergyman who should have been a fiddler. In medical jurisprudence, and indeed in the administration of justice generally, phrenology would create an entire revolution. The real maniac would at once be distinguished from the responsible agent, and crime might even be prevented by securing the thief and murderer before they had given scope to their propensities.

But neither is phrenology an established science, nor, if it were, can it ever be applied with certainty to the illustration of individual character. Many of the organs are so heterogeneous in their nature that they may indicate faculties or dispositions diametrically opposite, while others are furnished with compensating organs which balance the good or the evil of either, and thus render both ineffective. The organ of *secretiveness*, for example, which indicates a thief, also indicates a liar, an actor, and a novelist! It is even said to be necessary to constitute dignity of character! Again, you may have the organ of *destructiveness* developed largely, and yet be a peaceable and good man. How is this accounted for? Your organs of *cautiousness* and *benevolence* are brought to bear upon it, so that it is tamed down into a very harmless affair, and would not even hurt a fly. It may be said, therefore, to be kept more for show than use.

There are other circumstances in the way, which, even according to the phrenologists' own showing, must for ever prevent them from correctly judging of the character of man from the external surface of his cranium. An organ, they say, may be so extremely developed as to push the neighbouring organs from the places usually occupied by them; and sometimes several organs, in the vicinity of each other, are equally or proportionally developed, so that in place of a protuberance, from which the indication might be taken, a smooth or regular surface is met with. Now there are no fewer than five important organs in the line of each eyebrow, and if no distinct protuberance appear in this region, what is the observer to infer? Are the organs all deficient or all redundant? Must we estimate them by their absolute or relative size? Or if the smoothness arises from the extreme development of one organ raising up another, how are we to distinguish between the one which elevates and the one which is elevated? Cautious phrenologists, however, do not consider the functions of those parts of the brain which are in the region of the frontal sinus as being so well ascertained as those of the larger organs.

The fundamental doctrine of phrenologists is, that the size of an organ determines the power of the alleged faculty or propensity belonging to it. But size alone, they admit, is not in all cases a true criterion. In individuals of the neuro-bilious temperament the brain partakes of the general activity, and comes more readily into play than where the temperament is lymphatic. The vigour of any faculty, too, may be increased by education or exercise, or even by disease, without any corresponding increase in its size. Thus, if a man is found with a very

small organ, and a very vigorous manifestation of its supposed faculty, phrenologists escape from the fact by pronouncing the organ to be in a state of unnatural activity, from disease or some other cause. Combe has endeavoured to draw a distinction between the *power* and *activity* of a faculty, by saying that *size* indicates the presence of the one, though not of the other. But the distinction is without a difference. For what is the power of a faculty but its activity? What is Cautiousness, but a quick sense of danger? What Imitation, but a ready faculty of copying? What Language, but a copious elocution, or a prompt recollection of words? What Wit, but sparkling thoughts and apt illusions? What Destructiveness, but readiness to destroy, the *power* lying in the arm and not in the brain?

Phrenology claims to be called the science of observation, and phrenologists are constantly vaunting of the *facts* they can adduce in support of their theories. Their cry is, 'Come to our schools and collections, and observe along with us whether mental manifestations are or are not in constant proportion to cerebral development; whether a given shape of head is not always accompanied by a certain talent and a certain character. If this be not so we are in error.' The opponents of phrenology have on the whole responded comparatively little to this invitation. They have been so satisfied with the arguments adduced against the system from almost every point of mental and physical philosophy, that they have left the manipulating of heads and handling of skulls and casts to the phrenologists themselves. The result has been that phrenologists, being left to state their *facts* and balance their organs after their own fashion, have made out many what they call triumphant cases in support of their theory, and challenge their opponents to a refutation of the same. In a good many cases, however, the challenge has been accepted. For instance, Mr. Stone, president of the Royal Medical Society of Edinburgh, met them on their own ground, and by a series of the most indefatigable examinations and measurements of a vast variety of skulls fairly proved many of their hypotheses to be erroneous and false. The following are some of the results of his investigations:—1. By comparing the crania of eighteen murderers with two extensive series of crania, this able inquirer has undeniably shown that the crania of such criminals are not characterized by any superior development in the region of Destructiveness; and that, instead of being broader, they are frequently much narrower than crania in general. 2. The superior part of the cranium, to which region phrenologists have referred the organs of the moral sentiments, is frequently found higher and better in the crania of murderers than in crania in general. 3. The crania of murderers have not been found to exhibit any deficiency of anterior development; and sometimes, in contrast with other crania, the anterior region is even fuller and better developed in such criminals than in crania in general. 4. The posterior development, or quantity of brain behind the ear, to which region phrenologists refer the animal propensities, has not been found to exhibit any remarkable preponderance in the crania of murderers. 5. The region of the head to which the supposed organ of Acquisitiveness is referred, has not been found broader in notorious thieves than in individuals of exemplary character; and sometimes even narrower—proved by the distance from Acquisitiveness to Acquisitiveness having been taken in twenty-two thieves, and compared with the same dimensions in various persons, English, Scotch, and Irish, each class of individuals having been taken without any selection. 6. By a comparison of the heads of the same individuals thieves are frequently found to possess that region of the head, to which the organ of Conscientiousness is ascribed, more highly developed than individuals of exemplary character. Sir William Hamilton, who examined a very large number of skulls for the purpose of comparing the size of the frontal sinuses (two cavities in the fore part of the skull), came to the conclusion that as these cavities vary greatly in size in different individuals, and as such diversities are not made manifest by the external conformation of the head, therefore for the front part of the brain at any rate the so-called faculties could not be allocated with any certainty whatever.

The limits assigned to this article prevent us from entering upon the wide fields of physics and metaphysics with which the subject of phrenology is connected. Were it otherwise we might deny the existence of separate and independent *faculties* at all in the composition of what is called the human mind, which we believe to be one and indivisible; what are denominated *faculties* being rather different *acts* or rather *states* of it. But we confine ourselves to the theories and statements of the phrenologists themselves. We give them the benefit of their own assumptions, feeling assured that even with that their science is unable to uphold itself before the slightest investigation.

In looking over the list of faculties assigned by phrenologists to the mind of man, it is impossible not to be struck with their redundancy on some particular points, and their lamentable deficiency on others. Thus, we have both *form* and *size*. According to metaphysicians a knowledge of *extension* includes the two, *form* being but the comparative extension of the several parts of the same object, and *size* the comparative extension of two several objects. Again, the organs of *Combativeness* and *Destructiveness* coincide so nearly, that the absence of one would scarcely be missed if the other were in vigour. The use of Destructiveness is said to be to teach us to 'kill for food'—upon which it has been well remarked, that we should also have organs to teach us to *dig* for food, and to *roast* or *boil* for food. Such organs as *Concentrativeness* and *Adhesiveness* can never be considered as primitive faculties, but only as *intensifiers* of other faculties. What is the meaning of the development of an organ, but that the faculty attributed to it is strong; and wherein, therefore, lies the utility of such organs as concentrativeness and adhesiveness, which only mean a strong and constant attachment to any particular object? Besides, what proper distinction can be drawn between the organ of *firmness* and the organs of concentrativeness and adhesiveness? Some of the organs have balancing faculties, such as *hope*, which is balanced by *cautiousness; destructiveness* by *benevolence*, &c. But why have two organs where the two principles necessarily imply each other, and where either could be indicated by the elevation or depression of a single bump? It would be easier to bring down hope to the requisite standard, by diminishing its peculiar organ, than by leaving it large, and adding to the bulk of cautiousness. Or if a particular organ requires a compensating one, why not carry the principle out through the whole system?—why not match Veneration with an organ of Scorn, Language with an organ of Silence, or Acquisitiveness with an organ of Prodigality?

But the deficiency of the faculties attributed by phrenologists to man is still more remarkable than their occasional redundancy. This is well illustrated by Lord Jeffrey in an article of his in the Edinburgh Review (No. 88, for September, 1826), equally distinguished for acute investigation and playful ridicule. 'The great boast of phrenology,' he says, 'is that it

does not rest on fantastical and arbitrary abstractions, but on a correct observation of the varieties of actual character, and is applied not to a mere speculative and shadowy analysis of supposed qualities, but to the undeniable realities by which men are distinguished in common life. It takes no cognizance of such questionable existences as perception, memory, imagination, or judgment; but looks at once to the peculiarities by which the conduct and characters of men in society are marked to ordinary observation. Thus it finds one man actuated in all his conduct by a strong desire of fame, and immediately it sets down 'love of Approbation' as an original principle in our nature, and looks about for a bump on some vacant part of the skull, by the size of which the strength of this propensity may be measured! Another is distinguished by his love of money, and so Acquisitiveness is established as a primitive and inherent propensity! Another is a great talker, and forthwith Language is made a distinct and independent faculty! Another has a turn for making nut-crackers and mouse-traps, and what can be so natural as to refer this to the bulk of his organ of Constructiveness? Another shows a great love for children without indicating much benevolence to any grown creature, and nothing consequently can be plainer than that Philoprogenitiveness is an original sentiment. Some are quick at arithmetical operations, and what explanation can be so satisfactory as that they have the faculty of Number very prominent? Others remember all the cross-roads they have ever come through, and who can deny, therefore, that they are distinguished for their Locality? Some keep their papers, clothes, and furniture very nicely arranged, which can be attributed only to the degree in which they possess the faculty of Order; while there are others again—at least so Mr. Combe assures us—whose genius consists in a peculiarly quick observation of the size and weight of external substances, for whose sake accordingly it has been thought reasonable to create the special original faculties of Size and Weight! This, we must admit, is sufficiently simple and bold. But where is it to stop? If we are thus to take all the tastes, habits, accomplishments, and propensities by which grown men are distinguished in the concrete, and forthwith to refer them to some peculiar original faculty or principle, imagined for the mere purpose of accounting for them, the thirty-six original faculties of the phrenologists may at once be multiplied to 360 or 36,000, and room must be made upon the skull for as many new organs. Some men have a remarkable love for their children, and therefore we have a separate principle of Philoprogenitiveness. But other men have as remarkable a love for their parents, and why, therefore, should we not have a faculty of Philoprogenitorness, with a corresponding bump on some suitable place of the cranium? The affections of others, again, are less remarkable in the ascending and descending lines, and spread most kindly in the collateral. Can it be doubted, then, that we should have a Philadelphic principle to attach us to our brothers and sisters, and another to keep us in charity with our first cousins? If the fact that some men are distinguished for their love of wealth is a sufficient ground for assuming that Acquisitiveness is an independent and original principle of our nature, should not the fact of other men being distinguished for their love of dogs and horses justify us in referring this also to an inherent principle? Or upon what grounds can we refuse the same honour to the love of card-playing, gossiping, or agriculture? Some men —nay, some whole families—are notorious for lying, though addicted to no other immorality; some, the natural prey of the former, are proverbial for credulity; some for inordinate merriment and laughter; some for envy; some for love of society; some for telling long stories; some for love of noise, some for horror of it. Most of these, it appears to us, are quite as well entitled to the rank of primitive faculties or propensities as any on the list of the phrenologists. Undoubtedly they mark as conspicuously the character and manners of the persons to whom they belong, and are not in general so easily resolved into more general principles. Why then should they be excluded from the scheme of the phrenologists, and left without any organs in their improvident distribution of the skull? Nay, upon these principles, why should there not be a separate original faculty prompting us to the practice of skating, sailing, or planting? or towards the study of botany, mineralogy, anatomy, bookbinding, chemistry, gymnastics, or any of the other five hundred pursuits to which idle men are found to betake themselves with an engrossing and often passionate partiality?"

There are two arguments which have often been urged in favour of phrenology. The first is, that genius is generally partial—that a man is often an excellent musician who has no talent for painting or metaphysics. Now, without insisting on the facts that there are many causes which may lead a person to one pursuit, and that few succeed to eminence unless they confine themselves to one track, we may simply say that we find it just as easy to admit an *original disparity* in the existence called mind as an original difference in the size of the phrenological organs. The second argument is, that in dreaming one or more faculties are awake, while others are asleep; and if all acted by means of one organ they could not possibly be in different states at the same time. To this it may be answered that it is quite as difficult to understand why one of the intellectual organs should fall asleep while the others are awake, as why the mind should continue to act in some of its modes, and cease as to others.

Phrenology has often been accused of leading to materialism and fatalism; but with all its faults, we think it has been in this instance dealt with unfairly and unphilosophically. Phrenologists expressly declare their belief that the brain is not the mind, but simply the organized medium through which in this life it manifests itself. This doctrine does not appear liable to the charge of materialism. As to fatalism, the mystery remains the same whether an individual becomes the perpetrator of harm by the fibres of his brain or by his essential nature.

PHRYGIANS appears to have been the name of the primitive inhabitants of Asia Minor, since not only the Trojans, but also the Mysians and Lydians were so called. Under the Persian dominion Phrygia was the largest and most central province of Asia Minor. At a later period it was divided into Greater and Lesser Phrygia and Phrygia Epictetus, the north-western part of Phrygia proper. The principal cities were Apamea, Laodicea, and Colossæ. The inhabitants of this fertile region were early civilized, and paid much attention to grazing and tillage. The history of Phrygia is altogether connected with mythological events. Several of its kings are mentioned of the names of Gordius and Midas. On the death of Adrastus (B.C. 560) the royal family of Phrygia became extinct, and the kingdom became a province of Lydia. It afterwards formed a part of the Persian, and still later of the Roman Empire. In the music of the ancients the *Phrygian mode* was of a martial character.

PHRYNE, one of the most celebrated courtezans of Greece, born at Thespiæ in Bœotia. She arrived at Athens in a humble condition, but soon began to acquire wealth by trafficking in her charms. She

became the mistress of Praxiteles and of Hyperides; the former of whom immortalized her beauty by his art; the latter obtained her acquittal when she had been accused of atheism by exposing her charms to the aged judges of the Heliæa. This event was decisive of her success. She henceforth veiled her beauties, and sold her favours only at an enormous price. She became so wealthy that she offered to rebuild the walls of Thebes if the citizens would allow the inscription, 'Alexander destroyed them; Phryne, the courtezan, rebuilt them,' to be put on them. The Thebans declined the offer. At Eleusis she went naked into the sea before the assembled multitude, but this was probably to renew the impression of her charms. (See ANADYOMENE.) Phryne, or according to some, Lais, once wagered that she could melt the stern and rigid Xenocrates; but her temptations proved unsuccessful, and she declared that he was not a man, but a statue. Even in her old age she was not without admirers.

PHRYXUS. See ARGONAUTS, ATHAMAS, and HELLE.

PHTHISIS. See CONSUMPTION.

PHYLACTERY, called in Rabbinical Hebrew *tephelin*, was the name given to strips of parchment, on which were transcribed four portions of Scripture, two from Exodus and two from Deuteronomy. These strips were rolled up and put in small leather boxes, sewed up with the sinews of a clean animal. According to the great Jewish champion Rabbi Lepman, four of these boxes behoved to be put on the head in the place where the pulse of an infant's brain beats, to correspond to the four senses of seeing, hearing, smelling, and tasting; and one to be put on the left arm, opposite to the heart. They were attached by a leathern thong, as to the length and breadth of which very minute directions were given. These phylacteries were regarded as amulets, which protected the wearer from the power of demons, and hence their name, which is from the Greek *phulassein*, to guard. The authority for using the phylactery was founded on different passages of Scripture, particularly Exodus xiii. 16; and the use as a part of ordinary Jewish dress was so general that our Saviour himself is supposed by Lightfoot to have worn them, his censure of the Pharisees being directed not against the phylactery itself, but a hypocritical abuse of it.

PHYLLOPODA ('leaf-footed'), an order of Crustacea, possessing numerous feet, numbering eight pairs at least. The feet are of *foliaceous* or leaf-like structure, and are provided with *branchial* appendages, adapted to subserve the breathing or respiratory function. The 'carapace,' or shelly-covering protecting the head and chest of these forms, as in many other Crustacea, may be well developed, or the body may, on the contrary, be destitute of a covering. The eyes may be distinct; but in some cases they are more or less confluent or united, and are borne on feebly-defined stalks—the term *subpedunculate* being applied to the eyes on this latter account. A pair of mandibles or large jaws exist; there organs being of horny consistency, and being destitute of palpi, or 'feelers.' The first pair of legs are natatory in character, and possess bristle-like filaments. In their development the Phyllopoda pass through a metamorphosis; and in their earliest state the embryos appear as Nauplii (see NAUPLIUS)—that is, as unsegmented larvæ, which do not possess a carapace, and which are provided with a single median eye. In the genus *Nebalia*, which forms the only Phyllopod inhabiting the sea, the 'naupliiform' larva is succeeded by stages corresponding to that seen in the development of the familiar Crabs, and known as the *Zoea* phase of the metamorphosis.

All the Phyllopoda are of small size. The order is represented by the familiar 'Fairy Shrimps' (*Chirocephalus diaphanus*), met with in fresh-water ponds, which possess clear, delicate, bodies, and swim through the water back downwards. The curious 'Brine Shrimps,' found in the brine-pans of salt-works, and in the salt lakes of both the Old and New Worlds, are also comprised within this group. The *Artemia salinus* or 'Brine Shrimp,' found in the Lymington salt-pans, exemplifies these latter forms. This form inhabits a briny solution strong enough to pickle beef. An allied form, *Branchipus stagnalis*, is found in pools and ruts.

The genera *Limnadia* and *Apus* differ from *Branchipus* and *Artemia* in possessing a distinctly developed carapace. In *Limnadia* the carapace exists in the form of a shelly structure composed of two pieces, and which opens along the ventral or lower aspect of the animal. The number of feet in this genus varies from eighteen to thirty pairs. In the genus *Apus*—the species of which occur in great numbers in ponds and ditches after heavy rains—the carapace has the form of a shield, inclosing the anterior parts, and the front portion of the abdomen also. In Apus the feet number sixty pairs; all being of leaf-like conformation, save the first pair.

The Phyllopoda, minute and apparently unimportant members as they are of the great Crustacean class, are invested with a high interest to the palæontologist, on account of the affinities they present to those extinct Crustacea to which the name of *Trilobites* has been given. (See TRILOBITE.) Structurally, these curious fossil organisms should be placed in all probability near to the Phyllopoda; from which, however, they widely differed in the perfect nature of their exoskeleton, as well as in other parts of their organization. The Phyllopoda themselves are represented as fossils in the Palæozoic rocks. The genera *Hymenocaris*, from the Upper Cambrian system; *Caryocaris*, from the Lower Silurian; and *Ceratiocaris*, from the Upper Silurian, represent this order. The genus *Dithyrocaris* occurs in the carboniferous limestone, and the doubtful example of *Estheria*, from the Devonian Rocks, should also, in all probability, be referred to the Phyllopoda.

PHYLLOXERA, a genus of insects noted as causing amongst the vines of France and other countries a serious form of disease. The Phylloxera unquestionably originated from the United States of America, although this statement is denied, as will hereafter be noticed, by some naturalists. Mr. Fitch, an American entomologist, being charged in 1854 by the state of New York to report on the insects beneficial or injurious to the agriculture and crops of the state, discovered on the leaves of vines numerous small gall-like excrescences. These 'galls' were situated on the lower surface of the leaves, and each excrescence appeared to open at its apex or upper part by a small aperture, the margin of which was surrounded by hair-like filaments. Within each gall, and at its lower portion, a small insect was found. This creature possessed a rounded convex body, short legs, and a suctorial form of mouth. The antennæ were filiform and obtuse. These insects were invariably found to be *females*, and the eggs produced by each numbered several hundreds. A study of the genesis of these insects showed that the eggs gave origin to larvæ, which ascended to the upper parts of the vines. Each larva in its turn, by biting or eroding the plant-surfaces, produced a new gall, in which it speedily became inclosed in the same manner as the parent. Mr. Fitch, comparing the galls and the entire life-history of the vine-insect to the galls seen in the leaves of the elm-tree and poplar, and which are formed by various species of Pemphigi, named the

vine-pest *Pemphigus vitifoliæ*. It was ascertained that the malformations thus produced on the vines did no apparent harm to vigorous and healthy plants.

Two other American entomologists, Mr. Benjamin Walsh and Mr. Charles Riley, also described the new Pemphigus of Fitch, and included it in the list of insects which were injurious and hurtful to the interests of the agriculturist. Dr. Henry Shimer, in 1867, describing the same galls and their included insects, also added the important observation that he had discovered an individual differing from those seen by his predecessors, which was provided with wings, and was considered by Shimer to be a *male*. This latter authority, therefore, separated the vine-pest from the genus *Pemphigus* of Fitch, and named it *Dactylosphæra vitifoliæ*.

Meanwhile the so-called Pemphigus appeared on the other side of the Atlantic, being found in vineries at Hammersmith, near London, in 1863, and in other parts of England and Ireland in 1867–68. Mr. Westwood, studying the insect, assumed it to be an entirely new species, and named it *Peritymbia vitisana*. Westwood was fortunate enough to see the insect under forms in which it had not previously been noted. He thus found it on the leaves of the vines, in the galls, and also on the roots of the plants, existing in the latter condition in the form of a subterranean grub-like creature. Westwood's observations were not published until 1869, when the insect was found in the south of France.

Some years previously to 1869 a malady of unknown nature affected the vineyards on both sides of the Lower Rhône. At Pujault in Gard it had been vaguely met with in 1863. But in 1867 it had assumed so formidable proportions that the vine-growers of Le Comtat, of La Crau, of the Alps, and in the neighbourhood of Tarascon, began to take serious alarm for the welfare of their crops and industry. A vine-grower of Arles, M. Delorme, had described the outward appearances and symptoms of the vine-malady, without saying or suggesting anything as to its origin or cause; whilst the peasantry gave to the disease the name of *le blanquet* or 'rot.' The latter confounded the disease with a malady showing itself in vines planted by ingrafting them in oak. But it is needless to remark the new vine-malady was an entirely different affection from the 'rot' of the peasants. The Phylloxera causes a kind of gangrene or decay of the vine-roots; the gangrenous matter having a blackish colour, but possessing no odour of fungi, as is perceptible in 'rot.'

After 1867 the evil still increased. The Agricultural Society of Vaucluse and other allied bodies met in consultation in July, 1868, and applied themselves to the investigation of the phenomena of the disease in the vines. They discovered no insects, fungi, or parasites sufficient to account for the symptoms, although the sweeping and ever-extending progress of the malady through the the vineyards seemed to point to a *living* cause as the origin of the epidemic. 'It marches like an army,' was the felicitous expression of a vine-grower in describing the ravages of the plague.

Marks of a yellow colour and some stains were, however, observed by the naked eye at the roots of vines, these marks being disclosed by the exposure of roots by the blow of an axe. Microscopic investigation of these markings showed that they consisted of a collection of insects with suctorial mouths; and further investigations of an analogous kind revealed the fact that insects of minute size, burrowing below ground, and multiplying by myriads, caused the strongest vines in time to succumb and decay.

The structural relations of these insects formed the next point to which the attention of naturalists was directed. These wingless insects of the French vines were at first named by Professor Planchon of Montpellier *Rhizaphis*, or 'pests of the roots.' This latter investigator determined, however, to institute a close search for the winged form, which he believed should certainly exist; and accordingly he found it in the *pupa* or chrysalis state, with its wings still inclosed or in an imperfect state. On the 28th August, 1868, Professor Planchon saw this pupa hatched or enter the *imago* or perfect state. It then resembled an elegant little grasshopper, and was provided with four transparent wings. The name *Rhizaphis* was now changed to *Phylloxera* (literally, 'leaf-blaster'), under which designation the vine-pest has latterly continued to be known. Planchon further found it difficult to distinguish the Phylloxera of the vine from that of the white-oak leaves (*Phylloxera quercus*), which causes these leaves to assume a yellow appearance.

The relations of the Vine Phylloxera to the American insect described by Fitch and his fellow-naturalists were next investigated. On the 11th of July, 1869, Planchon discovered at Sorgues (Vaucluse), upon two branches of a variety of vine known as Tinto, several galls similar to those described as formed by the Pemphigus insect of America. At Bordeaux a few days afterwards M. Laliman discovered the same galls, but with the important addition, namely, that the Bordeaux galls were situated upon *American* vines, many of which carried Phylloxeræ on their roots also. Suspecting that the two forms of insects—namely, those of the leaves and those inhabiting the roots—were merely modifications of one another, the one being adapted for a subterranean and the other for an aerial existence, M. Lichenstein and M. Planchon at length arrived at the conclusion that the *Pemphigus vitifoliæ* of Fitch was simply the *Phylloxera vastatrix* of France. This hypothesis received striking and important confirmation when it was ascertained that the Phylloxeræ of the *galls* became transformed in the course of development into those of the *roots*. And Riley, the American entomologist, coming to Europe, confirmed the identity of the Phylloxera of France with the American Pemphigus; and in America Riley in turn discovered the insects in their subterranean condition, that is, existing on the roots, just as previously they had been found in that continent infesting the leaves in the form of galls.

The question as to the original habitat of the Phylloxera naturally cropped up in order, after its structural relationships had been fully determined. The first theory of the European origin of the Phylloxera was set aside as improbable. The insect, if of European origin, should, under the ordinary run of circumstances, have been heard of long before its discovery; and animal plagues of so great and grave a character are not suddenly or spontaneously produced for the first time in a country which has previously been entirely free from their inroads and devastations. On this hypothesis also we should have to account for the spontaneous and simultaneous appearance of the insects in various regions very far removed from each other. Another theory, enunciated by M. Koressios of Athens, held that the insect was not new to Europe—that, in fact, it was the old Phtheir or vine-insect described by Strabo, and which the modern Greeks still try to repress by means analogous to those employed in ancient times. The so-called Phtheir is, however, a widely different insect from the Phylloxera. It is the *Dactylopius longispinus*, allied to the cochineal insects; and it attacks in spring the outer parts of the vines, and covers them with a syrupy fluid, amid which a cryptogamous plant known as *fumagine* develops itself.

This insect thus devastates the vines of the Mediterranean and Black Sea coasts. A third suggestion, emanating from M. Nourrigat of Lunel, maintained that this so-called Phylloxera disease had already ravaged Europe about the eighteenth century, and was identical with that termed by the Germans *Gabel*, or 'fork-disease,' on account of the forked or bifurcate appearance observed in the branches of the affected vines. But this latter disease corresponds evidently to the *Cottis* of Charente, or the *Anthracnose* of Southern France, described by Esprit, Fabre, and Dunal.

That the Phylloxera is a native of, and indigenous to America forms the last hypothesis; and of the correctness of this statement there can be little doubt. It has thus been only recently introduced into Europe from the American continent. In proof of this theory it may, firstly, be mentioned that the Phylloxera occurs very generally on the *wild* vines of America as well as on the cultivated varieties; and the Phylloxera galls were discovered on a specimen of the *Vitis monticola* (gathered in Texas in 1834) by Berlandier the botanist. Planchon relates that he has seen this specimen in the herbarium of Dr. Engelmann of St. Louis, who stands unrivalled as an authority on the American species of vines. The existence of Phylloxera in the United States has been verified for at least forty years; and if documentary evidence could be obtained its history would be certainly found to extend to a period much further back. And considering that the culture of vines in the United States is a thing of comparatively recent date, that European vines do not grow well in America, and that whilst several American species can successfully resist it, none of the European species appear able to survive its attack—it is impossible after these facts to doubt that America has the credit of being the native region of the Phylloxera. Were it otherwise we should, firstly, have been aware in Europe of the ravages of the Phylloxera in former years, and the European vines should not have so inevitably and generally succumbed to its attack.

The proofs that the Phylloxera has been *imported* into Europe from America are also very clear. The entire circumstances attending the ravages of the Phylloxera point to its first appearing in any given district in the immediate neighbourhood of American vines. Thus in Gironde the Phylloxera appeared first at Floirac, near Bordeaux, in the centre of vines directly imported from America. From this point, as from a centre, it rapidly spread to adjoining vineyards, and since 1868 spread to still wider surroundings. In Austria the Phylloxera disease showed itself in a vinery at Klosterneuburg, near Vienna, and appeared exactly at the spot where American vines had been planted. These vines had been directly imported from the United States.

Regarding the *conditions* which favour the growth and propagation of Phylloxera little can be definitely said or determined. Cold, drought, and other causes have been put forward as explanatory and favouring causes, but without adding any real knowledge of the phenomena. Vine-growers have meanwhile not been idle in trying to elucidate means for the destruction of the Phylloxera. Poisonous solutions of various kinds have proved effectual in destroying the insects; and various means, from saturating the plants with pure cold water, to using solutions such as gas-water, solutions of ammonia, sulphuretted hydrogen, carbolic acid, arsenic, &c., have been tried. Two great difficulties, however, are met with in the application of such remedies; the first of these being to apply the solution so as to kill the insects without injuring the plants; and secondly, to apply such measures on a scale sufficiently large to include whole vineries, and at the same time to devote the necessary attention to each individual plant. Vines thus appear particularly liable to be affected by the action of gases, and it may be stated as a general result that all attempts to fortify the vines, or to prevent the spread of the disease in this manner, have as yet been futile.

Certain insects undoubtedly prey upon the Phylloxeræ in their turn, and it was suggested that these insects might be utilized for the destruction of their more important neighbour. Riley thus discovered a vermiform larva (*Pipiza radicum*) which he suspected lived on those Phylloxeræ which infest the vine-roots; and a second mite-like form, or acarus, allied to the cheese-mites and named *Tyroglyphus phylloxeræ*, was believed to infest the vine-pest. Some doubt, however, exists as to the exact nature and relations of this latter parasite, and the entire question of regarding the parasites as aids in the extermination of the Phylloxeræ cannot be said to present very hopeful or definite aspects.

An important observation, and one from which valuable results in the limitation or extirpation of the disease may be derived, was made in the years 1867–69 by M. Laliman, whose vineyard, situated near Bordeaux, had been almost completely devastated by the Phylloxera. This gentleman noticed that certain American vines flourished amidst those that succumbed to the disease, and these American forms remained healthy notwithstanding the very general decay of their neighbours. Led by this fact M. Laliman came to regard the healthy American vines as the proper species to replace those destroyed by the disease, and as likely to resist it in time to come. Mr. Riley of America, independently of M. Laliman's observations, was led to a similar conclusion; and M. Gaston Bazille, of Montpellier, suggested the idea of grafting European vines on those of America—a work which has already been attended with good results, although time alone can prove whether the vine-pest can be fully mastered, and its devastations as fully and completely repaired. The American vines which best *resist* the Phylloxera are those derived from *Vitis æstivalis*, l'Herbemont, the Cunningham variety, le Concord, the Prolific Hartford, the Ives Seedling, &c. The only species *not attacked* by the Phylloxera is the *Vitis rotundifolia*, termed Muscadine in its wild state.

PHYSETER. See WHALE.

PHYSICAL GEOGRAPHY is that branch of geography which treats of the surface of the earth, of the atmosphere which surrounds it, of the substances which compose it, and of the organized bodies which it produces or supports. (See GEOGRAPHY.) Physical geography does not, however, enter into the minute details of natural science; it gives a general view of phenomena and their mutual relations, and leaves to the more rigorous sciences the classification of the substances of which they treat, borrowing from each its results, and connecting them into one whole. The figure of the earth and its relations to the other parts of the universe are determined by mathematical geography; physical geography points out its natural divisions into land and water, continents, seas, oceans, &c., and treats of the external configuration of mountains, valleys, coasts, &c. Having examined the surface, we attempt to penetrate the interior, and determine the structure and composition of the solid parts of the earth, its strata, caverns, veins, &c.; the rocks or aggregate substances of which it is formed, their distribution, properties, age, &c.; we study the remains of its past inhabitants, and the proofs of the violent revolutions which it has undergone, and seek for the causes of those revolutions (See GEOLOGY and PALÆONTOLOGY.) We next exa-

mine the simple substances of which the earth is composed (see MINERALOGY), and their various combinations, from which we obtain so many contributions to our comfort, health, or luxury. If we then turn to the fluid parts of the globe, hydrography points out its divisions into lakes, rivers, seas, oceans; determines the different natural qualities of water, its chemical properties, &c. (see OCEAN, WATER); and the nature, extent, and causes of those great fluctuations which it regularly undergoes. (See TIDES, CURRENTS.) The fluid which surrounds the globe may next be examined (see AIR, ATMOSPHERE, METEOROLOGY), its composition determined, and the curious phenomena of which it is the theatre, and the movements to which it is subject, be studied. After concluding our examination of inorganic nature by researches into the local temperature of the atmosphere (see CLIMATE), we may next consider the earth as the residence of organized living beings, which adorn its surface and feed upon its inexhaustible resources. Vegetables, from the abundance with which they are produced, and from their intimate connection with the surface of the globe, first attract attention; botany examines in detail the treasures of the vegetable world, while physical geography marks its general relations, and traces the influence of climate, temperature, soil, atmosphere, &c., upon the progress and extent of vegetation, and the geographical distribution of plants. (See BOTANY.) Rising above the lowest form of organic to animal life, we search the air, the land, and the sea, following the motions of insects, reptiles, birds, fish, and beasts; and fix the boundaries within which they are confined, or the spot of their origin, and the progress of their migrations. (See ANIMAL, ZOOLOGY, &c.) Man in his physical capacity, his animal organization, his variety of complexion, stature, conformation, and mode of life; the proportions of the ages, sexes, deaths, and births; with the influence of heat and cold, moisture and drought, local habitation and climate, upon his body and mind, is the last and highest subject of physical geography. (See ETHNOLOGY, MAN, LONGEVITY, PHYSIOLOGY, &c.) See Somerville's or Ansted's Physical Geography; Lyell's Principles of Geology; the geographical works of Humboldt; Berghaus's Physical Atlas; Johnson's Physical Atlas, &c.

PHYSICIANS, ROYAL COLLEGE OF (Edinburgh), a body incorporated by royal charter dated the 26th of November, 1681, and empowered to make laws for promoting the art of physic, and to regulate the practice thereof within the city of Edinburgh, town of Leith, and districts of the Canongate, West Port, Pleasance, and Potterrow. No person was to be allowed to practise physic within these limits without a warrant from the college, and all medicines sold within the same limits were made liable to be inspected by the officers of the college, who were empowered to throw out into the street all such as were found bad or unwholesome. A warrant from the college is no longer necessary to a practitioner within the limits of its former jurisdiction; but the body is now represented in the general medical council established by the Medical Act of 1858, and fellows and licentiates of it are entitled, on paying the necessary fees, to be registered as qualified medical practitioners in accordance with the provisions of that act. See MEDICAL ACT.

PHYSICIANS, ROYAL COLLEGE OF, LONDON. This body owes its origin to the exertions of Thomas Linacre, one of the physicians of Henry VIII., who, through the influence of Cardinal Wolsey, obtained in 1518 from that monarch letters patent incorporating himself with certain other physicians named, and all other men of the same faculty in London, as one body. Various privileges were accorded to them, the chief of which was that of prohibiting any one from practising as a physician in London, or within a circuit of 7 miles round it, unless he had first obtained a license from this corporation. A charter granted four years later confirmed the privileges of the body, except that graduates of Oxford and Cambridge were permitted to practise within the jurisdiction of the college without previously being examined by it. Various charters have been granted to the body subsequently, but since the passing of the Medical Act of 1858, by which any duly qualified practitioner is entitled to practise according to his qualifications in any part of her majesty's dominions, the license of the college is not necessary to those practising in London or within 7 miles round. As at present constituted the corporation consists of a president and fellows (who alone form the governing body) and members. The fellows are a self-electing body, and are elected from the members of four years' standing. The members consist of persons who had been admitted before February, 1859, licentiates of the college; of certain extra-licentiates (that is, persons qualified under the powers formerly belonging to the college to practise anywhere in England except in London or within 7 miles round it); and of persons of at least twenty-five years of age, who do not dispense and supply medicine, who had been engaged in the study of physic for at least five years previous to their admission, and for at least four years at a medical school recognized by the college, and who, after having been duly proposed, have satisfied the college as to their attainments in medical and general science and literature. Members are entitled to the use of the library and museum and to attend all the college lectures. Licentiates of the college do not form part of the corporation. They must be at least twenty-one years of age, and must have studied medicine four years before being allowed to undergo examination. A fellow on being admitted must pay a fee of 30 guineas, exclusive of stamp duty; a member 30 guineas, and a licentiate 15 guineas. The Royal College of Physicians of London is represented by one member in the general medical council established by the Medical Act of 1858, and fellows, licentiates, and extra-licentiates of the body may, in accordance with the provisions of that act, be registered as medical practitioners. The same act empowers any college of physicians to pass a bye-law to the effect that no one of their fellows or members may sue for fees for professional aid or advice; and the Royal College of Physicians of London has taken advantage of this clause to prohibit their fellows from doing so.

PHYSIC NUTS, the name by which the seeds of the *Curcas purgans* (*Jatropha purgans*, Linn.), a shrub belonging to the natural order Euphorbiaceæ, are known, and which they have acquired in virtue of their strong emetic and purgative properties. The shrub from which they are obtained is a native of intertropical countries, principally the East and West Indies. Its height never exceeds 12 or 13 feet, but its stem is more than proportionally thick. Its leaves consist of five acute segments. Its flowers are of a dull yellow colour, and monœcious, the male flowers having from eight to ten stamens and the female flowers three styles, with thick stigmas, and five glands surrounding the ovary, which is three-celled. The emetic and purgative property of the seeds is due to a fixed oil which resides principally in the embryo. This oil is expressed and used in medicine under the name of Jatropha oil, for the same purposes as croton oil, although it is less powerful. The name of French or Spanish physic-nuts is given to the seeds of another member of the same genus, the

Curcas multifidus, a shrub which grows to the height of about 10 feet, and has a magnificent foliage. Its leaves are large, and palmated with nine lobes, of a dark green colour above, and glaucous beneath. Its flowers are of a bright red colour, and are arranged in cymes. It is a native of the same regions as the former species. The oil expressed from it is called Oil of Pinhoen, and is similar in its properties to Jatropha oil.

PHYSICS (Greek, *phusis* or *physis*, nature), or NATURAL PHILOSOPHY, is the study of the phenomena of the material world. The study embraces a larger field of science than that which is commonly implied when 'matter' is spoken of. It is only the naturalist (so we would term a natural philosopher) who has studied in the school of Newton, Faraday, and Thomson who can conceive the wonderful relations which exist between the material and all other sciences. There is still, however, a wide separation between the science of dead matter and the science of matter under the influence of life, and towards bridging this gulf very little has been done. We use our living thoughts to discuss dead matter; we perceive force by our muscular exertions; but life itself lies outside the pale of our investigations. There is really no logical division between the two sciences, material and mental. It is with the instrument, the human mind, that we study material phenomena; but we use this instrument as a person ignorant of optics may use a telescope or his eyes in viewing objects. Again, subjects which belong more particularly to natural philosophy are often studied to great advantage by the metaphysician, as for instance the subject of optics was studied by Reid, who enunciated his theory of corresponding points on the retina.

The first steps in investigating a phenomenon of nature are the observation and classification of facts, and these form what may be called the natural history stage of the inquiry. Arguing on these results by induction is the natural philosophy stage. The distinction between these two stages, the more elementary or more observational and the more scientific stage, is of considerable importance in all branches of natural science, astronomy, geology, chemistry, and biology. Mental science has corresponding divisions, mental history being the preparatory and mental philosophy the more advanced stage. Astronomy has long emerged from its natural history stage. Among the Chaldean shepherds, who might notice celestial objects as they noticed plants and animals, we can imagine astronomy to have been classed with other natural history sciences. Now, thanks to long-continued observation and reasoning, we feel on looking at celestial objects that they are bodies we know about, and in our very thoughts astronomy has emerged from the natural history stage. And yet for further progress we still employ natural history methods. With the aid of the spectroscope we can observe phenomena which we cannot explain; for instance, we learn that some stars give different lights when viewed from different quarters, a fact inexplicable at present.

In the first study of minerals we are concerned as to whether they are mere crystals or the remains of plants and animals. When we find a bone or a leaf it is admitted that there has been an animal whose bone or a plant whose leaf has been found. Fossils evidently indicate the previous existence of living creatures. Palæontology is the name given to that branch of geology which deals with biology. Some great geologists employ a palæontologist to help them in special investigations; others, like Agassiz, are great geologists and palæontologists at the same time. The geologist must also consult the chemist as to the compositions of minerals. The dynamic branch of geology, dealing with the forces which have given its present shape to the earth's crust, has hitherto perhaps been prosecuted rather rashly; yet no other branch of natural science has been of so much use in opening our minds to our position on this globe. Dynamics answers such questions as 'How rigid must the earth's crust be, supposing the interior parts to be liquid, to withstand the decomposing actions of the sun and moon?' The tides exhibit very visibly the yielding of the waters on the earth, and it is proved by dynamics that unless the earth's crust were preternaturally rigid there would be no visible water-tides, because of the yielding of the crust itself. We see, however, that the crust does not yield sensibly, and we are compelled to believe that the earth's crust is not thin. In fact dynamics shows that the earth contains comparatively little fluid matter, and that it is on the whole much more rigid than glass or iron.

Every part of natural philosophy is connected with dynamics, the science of force; and the greater our knowledge of a subject the more we employ dynamical methods of investigation. In combustion we have forces of attraction of particles, and the phenomena of chemistry are every day becoming more and more comparable with the ordinary dynamics of falling bodies. Magnetism shows itself by forces of attraction and repulsion. We cannot yet explain the phenomenon. We see that a certain wonderful property may be communicated to a piece of steel; this property is an external dynamic phenomenon produced by internal dynamics which we do not see, just as external phenomena are produced by the internal invisible mechanism of a clock. We know that magnetism is a certain motion, and that there is a certain 'allignment' of rotation in the axis of the magnet. Heat too is certainly a mode of motion. Light is a motion of a subtle medium pervading space. There are striking relations existing between light and electromagnetic phenomena.

We find then that every division of natural philosophy is founded on dynamics, the science of force. The science used to be called mechanics, but Newton confines this term to its strictly literal meaning, the science of machines (it is derived from *mēchanē*, a contrivance); as force was obviously concerned in machines the term came to be used for the science of force. Professors Thomson and Tait have protested against the misuse of the term. The science of dynamics is subdivided into statics and kinetics. Statics relates to forces in equilibrium, kinetics to force and motion. The term kinematics was given by Ampère to the study of motion irrespective of force. It is evident that a problem in statics has a kinematic and kinetic basis. There are divisions of dynamics depending on the condition of the matter whose motions are investigated. Thus hydrodynamics is the dynamics of water and other fluids; it is subdivided into hydrostatics and hydrokinetics, treating respectively of the equilibrium and motions of fluids. Branches of hydrodynamics are pneumatics, static and kinetic, the science of gases. Acoustics, the science of hearing, is intimately connected with pneumatics, sounds being communicated to the ear by the vibrations of gases. It is also connected with almost every other branch of natural philosophy. It rests on a well-established dynamic basis. The articles treating of physics in this Encyclopædia are numerous and need not here be specially referred to. Thomson and Tait's Elements of Natural Philosophy, vol. i., treats of dynamics. Students are also recommended to read Everett's translation of Deschanel's Natural Philosophy, brought out by the publishers of this work.

PHYSIOCRATIC (or AGRICULTURAL) SYSTEM, in political economy. Francis Quesnoy, physician to Louis XV., had observed the very depressed state of agriculture in France whilst travelling with the king, and ascribed it to the mercantile system introduced under Colbert, which favoured the industry of the cities. Quesnoy published his Tableau Économique avec son Explication (1758), and developed his system in his La Physiocratie, ou Constitution Naturelle du Gouvernement le plus avantageux au Genre Humain (Paris, 1767), and a whole school, called the *physiocratic*, soon sprung up. It was not, however, until the reign of Louis XVI., under the minister Turgot, that the followers of the system came into office. Their authority again sunk, but in the revolution they had for several years a decided preponderance in the convention. Joseph II. of Austria, and Leopold of Tuscany, his brother, were friendly to the system, but did not allow the perfect freedom of trade which it recommended. The principles of the physiocratic system are—1. The earth is the only source of all national wealth; and only those who use or increase the natural powers operating in the vegetable and animal kingdom, as farmers, fishermen, herdsmen, miners, add to the amount of actual wealth. All other labourers, mechanics, manufacturers, merchants, produce nothing which can increase the public wealth; they only change the form of the articles produced by the former classes, and their wages will always be paid by the surplus of raw products, which the farmer saves from his own consumption. The merchant only promotes the exchange of goods. Still less is it in the power of public officers and men in similar employments to increase the elements of wealth. 2. All members of the community, therefore, are divided into productive and unproductive. To the latter class belong scholars, artists, mechanics, merchants, &c., because all of them are to be supported by the productions of the earth, without having assisted directly in producing them. What they save from the wages received from the mass of the natural products, in various forms, contributes, indeed, to national wealth, and they become thereby a useful class of citizens, indirectly increasing wealth. It is only by their means, moreover, that the agriculturist is enabled to devote himself exclusively to the culture of the earth. 3. From this it follows that the unrestricted exercise of all honest occupations is necessary to the wealth of both classes. The system inculcates freedom in regard to foreign commerce, as well as to the mechanic arts, considering it a matter of indifference whether the products of a country are consumed by natives or by foreigners. 4. As according to this system all wealth is derived from the soil, the only subject taxed should be the net produce of the soil. The untenableness of this system, without replying to it in detail, rests chiefly in the misconception of nature and its products. The fire of the steam-engine is as much a productive natural power as that producing grain, and the plough as much a machine as the steam-engine.

PHYSIOGNOMY (Greek *physiognōmonia*, literally, the knowledge of nature), is the name given to the countenance of man, considered as an index of his general character, and also to the science which treats of the means of judging of character from the countenance. Whatever be thought of the possibility of laying down strict rules for such judgments, it is a fact of every day's occurrence that we are, almost without reflection on our part, impressed favourably or unfavourably, in regard to the temper and talents of others, by the expression of their countenances. As the face is that part of animals in which the noblest organs are united, by which they put themselves in contact with the world, and, for various reasons, shows most of their characteristic traits, it has been made the particular object of study by the physiognomist. Aristotle is the first who is known to have made any attempts in physiognomy. He observed that each animal has a special predominant instinct; as the fox cunning, the wolf ferocity, and so forth, and he thence concluded that men whose features resemble those of certain animals will have similar qualities to those animals. Baptista della Porta, in his work De humana physiognomia (1586), revived this theory and carried it out further. The French painter Lebrun, in the next century, executed a series of designs expressing the relation between the human figure and that of animals; and the theory that such a relationship is indicative of human character was also adopted and illustrated by Tischbein, a German painter of the eighteenth century. The physiologist Camper, extending the study of physiognomy, sought new data in a comparison of the heads of different types of the human species, and in attempting to deduce the degree of intelligence belonging to each type from the size of the facial angle. Lavater was the first to develop an elaborate system of physiognomy, the scope of which he enlarged so as to include all the relations between the physical and moral nature of man. (See LAVATER.) A great part of the art of painting and sculpture is founded on physiognomy. As the expression of the face depends very much upon the formation of the fore part of the skull, physiognomy is illustrated by craniology. Among the chief points in physiognomy, Kant, in his anthropology, reckons—1. the general formation of the face, particularly in the profile, which is interesting, both in respect to the physiognomy of individuals and of nations, as Blumenbach's investigations prove; 2. the features of the face; 3. the motions of the face, as far as they have become habitual; also the walk, &c. Kant and others think they can show why physiognomy can never be elevated to a science. It is, however, a subject of great interest, but the student must be on his guard against a general application of the rules which experience seems to have furnished him. This was the reason why Lavater's system lasted but a short time, though he has collected valuable materials. Among the works on physiognomy are Michael Scott's De procreatione et hominis physionomia opus (Paris, 1477); Dissertation sur les différences réelles que présentent les traits du visage, by Camper (Utrecht, 1791); An Attempt to Establish Physiognomy upon Scientific Principles, by J. Cross (Glasgow, 1817); De la pysiognomie et des mouvements d'expression, by Gratiolet (Paris, 1865), besides Lavater's works on the subject. See LAVATER.

PHYSIOLOGY. This name is applied in medical and biological science to the department of inquiry which investigates the *functions* of living beings. The name 'science of function' has therefore come to be regarded as synonymous with 'physiology,' and the term 'institutes of medicine' has also been applied to this science, from its affording the knowledge of normal functions necessary for the due appreciation of these functions when abnormal or diseased. The word physiology is derived from the Greek *physis* or *phusis*, nature, and *logos*, science; and in the Aristotelian philosophy it signified, in a wide and general sense, the entire knowledge of natural objects, including thus the modern sciences of natural philosophy or physics, natural history, &c. As limited at the present time, however, the science of physiology has for its aim the elucidation of the actions and processes incidental to and characteristic of the *living* state. In its wide sense, therefore, the living functions of both animals and plants fall to be investigated by physiology, this division of the subject being

comprehended under the terms *comparative physiology* and *animal* and *vegetable physiology*. When more specially applied to the investigation of the functions in man the appellation *human physiology* is applied to the science.

The importance of physiological inquiry, already alluded to in connection with the observation of diseased conditions, cannot be overrated. The knowledge of healthy functions is absolutely necessary for the perfect understanding of diseased conditions; and the science of *pathology*, dealing with the causes and progress of diseases, may in this way be said to arise from, and to depend upon, physiological inquiry in the first instance. Physiology in itself thus forms a link connecting together the various branches of natural history or biology and those sciences which are more specially included within a medical curriculum.

The progress of physiology has of late years been of an exceptionally rapid kind; and in the earlier history of the science there is much to interest and instruct. The broad science of physiology, as known to and studied by Aristotle and the early naturalists, was the first cultivated department of inquiry relating to living beings. It was first taught and investigated as a part in the systems of 'philosophy' which were so numerous in the classical ages. Pythagoras, Empedocles, Alcmæon, and other philosophers, amid their discussions on abstruse metaphysical subjects, did not altogether neglect to notice the human body, its structures and functions. And such notice, as the beginnings of physiological science thus obtained, although of a very superficial character, yet serves to show us that, insensibly perhaps, but none the less surely, the study of living structures was deemed an essential part of philosophic systems and modes of thought. About 460 B.C. as to time, and in the person of Hippocrates, the science of physiology received more definite attention, and assumed a certain degree of importance in laying the foundation of the system of medicine of that old Greek worthy. The works of Hippocrates afford undoubted evidence that his observations upon diseased conditions had suggested the desirability of an acquaintance with normal functions and structures. Indeed, his speculations as to the ordinary functions of the human body definitely show that the physiological knowledge of Hippocrates, if crude and in many senses erroneous, was at all events of a comparatively extensive character, considering the few opportunities and means afforded him for making observations. About 428 B.C. we find Plato in his lectures embodying certain ideas relative to the formation of the human body, and to the mode in which its elements and parts were arranged. The speculations of Plato had perhaps a chief reference to the 'soul' or 'anima,' and to its relations with the body; and his knowledge therefore more resembled that included in modern ideas and times under the idea of the science of psychology, or the physiology of mind. Succeeding Plato we find Aristotle, about 384 B.C., making great advances on the physiological knowledge of his predecessors, and combining with that knowledge much information concerning the details of structure also. In Aristotle's Natural History of Animals frequent physiological details are interspersed among his accounts of the anatomy of living forms. The Alexandrian school of science, flourishing about 280 B.C. under the Ptolemies, and represented by Erasistratus, Herophilus, and others, obtained greater opportunities for the acquirement of physiological knowledge, through the investigation of the bodies of criminals who had been executed. Erasistratus thus threw much light on the nervous system and its physiology; whilst Herophilus made important observations on the pulse; and in addition discovered the lacteal or absorbent vessels.

After this period came the 'dark days' of physiological science, and of other branches of knowledge. Galen, living in the second century after Christ, may be said to be the first who awoke the world from its slumbers; and by the brilliancy of his intellect, by his fervour and zeal, by his eloquence and his learning, this distinguished labourer effected a vast advance and improvement in physiological knowledge. Besides numerous researches on the structure and organization of the living body, Galen is noteworthy as the first who introduced the method of interrogating nature by experiment. He thus proved that muscles depended for sensation and their power of motion upon the nerves with which they were supplied, by dividing the nerves and thus paralyzing the muscles. He showed that the arteries did not contain air, as was believed by his predecessors, by exhibiting the living vessels filled with blood. He enlightened his contemporaries as to the functions of the kidneys, and of the bile-duct; and in many other respects largely increased the store of medical knowledge of his day. The systems of thought which succeeded Galen and his times consisted, until about 1543, of absurd speculations and theories, conducive in no respect to the advance of true knowledge and research. Paracelsus then appeared with his alchemy and astrology. Van Helmont explained life and its origin by an intelligent being or *archæus*, which had its seat in the epigastrium; whilst Descartes' doctrines of automata and animal spirits may also exemplify a few of the many speculative systems characteristic of the middle ages.

In 1543 Vesalius the anatomist paved the way towards the more definite scientific epochs of modern times by his investigations into the anatomy and structure of the human frame; a work which ultimately cost him his life, since this shining light of science perished by shipwreck whilst returning from the Holy Land in 1564, whence he had been sent by the Spanish Inquisition in expiation of his alleged offence of dissecting men whilst alive. In 1619 Harvey, the 'father of modern physiology,' discovered the circulation of the blood, this discovery marking a very important and significant epoch in physiological knowledge. In 1622 Asellius described the lacteals and their function; and in 1651 Rudbeck of Sweden noted his observations on the general lymphatic or absorbent system. Of Harvey's further researches in connection with reproduction nothing further beyond mentioning these may be said to show the important advance which had thus been made on the uncertainty and speculations of the older *savants*. Rudbeck traced the lacteal or lymphatic vessels of the intestines to their termination in the thoracic duct; a labour in which Bartholin and Jolyffe about the same time participated. Malphighi is also to be remembered as an original physiological worker of the same century, and as having chiefly devoted himself to the examination of the intimate or minute structure of many organs and tissues of the body, a labour leading to the better understanding of their physiology and functional uses. To Ruysch, a contemporary of the preceding physiologists, belongs the credit of first injecting vessels with wax, &c., and of so tracing them throughout their more minute ramifications. Boerhaave, dating about the close of the seventeenth and beginning of the eighteenth century, made some few original observations, but did not materially aid the advance of physiological science. On Hoffmann and Stahl as physiologists much the same opinion may be passed; but on Haller, who flourished about the middle of the eighteenth century, a very different judgment must be pro-

nounced. His Elements of Physiology contain much original matter, derived from his own observation and research. Haller experimented and investigated boldly, and to many of his pupils, among whom may be enumerated Zimmermann and Meckel, he communicated much of his energetic spirit for investigation. The epithet 'the modern father of physiology,' which has been applied to Haller, is as deservedly bestowed as that of 'father of medicine' was on Hippocrates of old. Succeeding Haller we find the more modern school of physiologists to include the names of John and William Hunter, Cuvier, Bichat, Blumenbach, Magendie, Flourens, and Von Baer; and to extend this historical glance further would be simply to enumerate the names and labours of living *savants*, by whom much important work is continually being achieved.

One noteworthy peculiarity of modern physiological research may be briefly referred to in concluding this historical notice. This peculiarity or feature consists in the introduction and extensive use into physiology of the experimental mode of investigation; and of elaborate and delicate instruments and apparatus, by means of which many interesting results have been attained which otherwise would have been wholly lost to science. To mention the sphygmograph, or pulse-recorder of Marey; the myographion, for determining the electrical currents of muscle; the ophthalmoscope, much used in investigating the normal and abnormal structure of the eye; and the laryngoscope, for exploring the cavity of the larynx, will be sufficient as showing the delicate and important apparatus now at the command of the physiologist, and through him placed at the service of the physician. With the improvement of that all-important instrumental adjunct to the biologist, the microscope (which see), physiology has made rapid strides in the more exact determination of the structural elements and intimate composition of living textures. So wide, indeed, is the field which microscopical inquiry has opened up to physiologists that a special branch of the science has been constituted, for the study of the minute structure of tissues and organs in their obvious relationship to the functions which these organs perform. Thus the department of *microscopic physiology*, or *histology*, has arisen, and from the research thus prosecuted vast additions have been made to other departments, not only of physiology, but also of other and widely-removed sciences.

Contemporaneously, too, with the above department of physiological inquiry, the science of *physiological chemistry* has been making rapid strides, and the composition of the fluids and tissues of the living body, in their relation to the functions of the organism, are now investigated with great success and with valuable practical results.

The different departments of physiology may be enumerated as comprehending the investigation of the three great functions which every living being performs. These include, firstly, the function of *nutrition*. Under this head (see NUTRITION) we investigate the nature and composition of foods and aliments; the processes of mastication, insalivation, deglutition, and digestion—the latter process of itself involving the consideration of the entire alimentary functions, whereby the food is subjected to the action of the various fluids furnished by the digestive glands, such as the liver, pancreas, &c. From digestion we pass to absorption, or that function whereby the food-products, now digested, are taken up or absorbed by the lymphatic vessels, and poured into the current of the circulation, or blood. This leads us to consider the blood itself, its circulation, its mode of nourishing the tissues; and its return to be purified, loaded with tissue-waste, in the breathing organs. Respiration and the composition of air next engage our attention, and under this head we investigate the process of blood-purification, together with the important subject of the elimination from the system by the skin, kidneys, lungs, &c., of the products of the tissue-waste. Every function whereby the nutrition of the organism is effected, maintained, and subserved, in short, falls to be investigated under this first head.

The second function is that of *correlation*, *innervation*, or *irritability*. Under this head the functions of the *nervous system* are investigated and determined, these functions being the media through which, as it were, the organism is brought into relation with the world in which it lives, and through which it reacts upon the world. The last function is that of *reproduction*, under which are comprehended the generative acts which result in the production of a new being, and which thus repair the losses death or disease make in the species at large. The phenomena of *development*, or the changes evinced during the progress of the being from its young or embryonic to its mature or adult state, are also included in the study of the reproductive function.

Every living being therefore, viewed physiologically, nourishes itself, reproduces its species, and possesses or appreciates through its nervous system certain relations with surrounding media. The mode in which it thus, through these three great functions, maintains its normal existence forms the study of the physiologist. And coincident with this study we may also find certain points bearing a general relation to these more special departments of inquiry. The primary question which thus meets the physiologist is connected with the investigation of the nature of *life* and *vital phenomena;* and he has thus first to determine if possible the nature of the vital principle, and thence proceeds to deal with its more obvious manifestations. In short, physiology deals with the living being in all its active functional aspects, beginning with its life, proceeding next to investigate its living mechanism, and finally tracing its growth through the earlier stages of development onwards to maturity, decline, and death.

The various physiological processes, functions, and special subjects relating to this science are treated of in detail under their respective headings, such as ALIMENT, DIGESTION, RESPIRATION, GENERATION, SKIN, TONGUE, EYE, EAR, LARYNX, &c.

PHYTOLOGY (from Greek *phuton* or *phyton*, a plant, and *logos*, science), a word sometimes used for *botany*, especially in Germany. See BOTANY.

PIACENZA (anciently *Placentia*, French *Plaisance*), a town in Italy, capital of the province of the same name, in a large and fertile plain, nearly equidistant from Parma and Milan, at the confluence of the Trebia with the Po. It is a place of some strength, and has some spacious, but a far larger number of narrow, gloomy, and deserted-looking streets. The principal street is the Corso Stradone, which has few to equal it in Italy, and contains numerous magnificent private houses, built after the designs of the most celebrated Italian architects. The principal edifices are the cathedral and other churches. The cathedral was mostly built between 1122 and 1233, but has some additions belonging to the fifteenth century. Some of the churches, particularly that of the Maria di Campagna, ascribed to Bramante, and having a noble dome, are very beautiful and rich in paintings. The town-house (Palazzo del Commune), of the thirteenth century, is one of the finest structures of its kind; the Palazzo Farnese, erected during the reign of Margaret in 1558, is one of the first great works of Vignola. The manufactures consist of various descriptions of cotton goods,

woollens, stockings, hats, leather, &c., and there are also several silk spinning and paper mills. It is the see of a bishop and the seat of a supreme court of appeal. Piacenza was originally a Roman colony and was founded along with Cremona in 219 B.C. It became an independent republic in 1126. It lost its liberty in 1254, passed under the hands of various masters, among others the Sforzeschi, under whom it followed the fortunes of Milan. After the battle of Ravenna in 1512 it became subject to the popes, one of whom, Paul III., bestowed it in 1545, along with Parma, on his son Pierluigi. Its subsequent history is identified with that of Parma. The battle of Trebia, in which Hannibal defeated Sempronius, was fought in the vicinity of this town. Among the distinguished natives of Piacenza are Lucius Calpurnius Piso, father-in-law of Julius Cæsar, Pope Gregory X., Alessandro Farnese, and Pietro Pallastrelli, a celebrated navigator, and father-in-law of Columbus. Pop. (1881), 34,987.

PIA MATER. One of the membranes investing the brain. See MENINGES.

PIANA DEI GRECI, a town in Sicily, in the province of Palermo, and 10 miles S.S.W. of the city of Palermo, inhabited by a colony of Albanese, who took refuge here in the fifteenth century, in the time of the Ottoman sultan Mahomet II., and still retain their peculiar manners and the religion of the Greek Church. Pop. 7714.

PIANO (Italian), soft, slow; used in music in contradistinction to *forte*. *Pianissimo*, the superlative of *piano*.

PIANO-FORTE, or PIANO, a musical stringed instrument, the strings of which are extended over bridges rising on the sounding-board, and are made to vibrate by means of small felted hammers, which are put in motion by keys, and where a continued sound is not intended to be produced have their sound deadened immediately after the touch of the keys by means of leathern dampers. Its name is compounded of two Italian words signifying soft and strong, and it was so called in contradistinction to the harpsichord, the instrument which it superseded, and which did not permit of the strength of the notes being increased and diminished at will. The mechanism by which the movement of the keys is conveyed to the strings is called the *action*, and there is no part of the piano-forte in which the variations are more numerous. The principal improvements which have been effected in this mechanism consist in contrivances for enabling the performer to strike the keys with as much or as little force as he pleases, for enabling him to repeat when necessary the same note after the shortest possible interval of time, and for preventing a rubbing contact of the hammer with the string, and thus securing a clearer sound. There are usually three strings in the piano-forte for each tone in the higher and middle octaves, two in the lower, and one in the lowest notes. The strings are of steel wire. The lowest notes have their strings wound round with a double coil of brass wire, and those next above with a single coil. The bi-chord and tri-chord notes have no such wrapping. A softening or loudening of the tone is produced by means of pedals. (See PEDAL.) Piano-fortes are either in the form of the grand piano-forte, in which the strings lie in the direction of the keys, or they are of a square or tabular shape with the strings crossing horizontally the direction of the keys; or they have the strings stretched vertically perpendicular to the keys, which is now the most common form, and constitutes the upright piano. The square piano-forte is no longer made. Grand piano-fortes are used as concert instruments, and have the greatest compass and strength. The bijou-grand piano-forte is a smaller instrument than that used for concerts, but has a peculiar arrangement of the strings by which almost as much power of tone is given to it as to the larger instrument. The strings lie in two layers, the tenor and treble strings in the lower layer, and the bass in the upper layer, which is at a different angle from the lower. This arrangement allows of greater length being given to some of the strings than could be done on any other plan. The common compass of piano-fortes at present is six and seven-eighths or seven octaves. The invention of the piano-forte can scarcely be ascribed to any one man in particular, as it was only by a succession of improvements extending over a considerable time, and introduced by different persons, that it reached anything like completeness. The first satisfactory hammer-action appears to have been invented by an Italian of Padua, named Bartolommeo Cristofali, about 1711. About 1716 a Frenchman named Marius exhibited before the Academy of Sciences of Paris three models of instruments of this kind in which the strings were struck by hammers; and a little later a German organist of Nordhausen, called Schröter, appears to have invented a similar instrument independently, two specimens of which he presented to the Elector of Saxony in 1721. The instrument was not introduced into England till the latter half of the eighteenth century. Among the principal improvers of the piano-forte are Sebastien Erard, the founder of the celebrated firm still in existence; Roller et Blanchet, the French firm which introduced the upright piano; Broadwood, Collard, Wornum, Leitter, Hopkinson, Kirkman, &c.

PIARISTS, fathers of the pious schools (*scholarum piarum*), the members of a religious order, who, in addition to the three usual monastic vows, took also a fourth, namely, to devote themselves to the gratuitous instruction of youth. This order was instituted at Rome, about the end of the sixteenth century, by Joseph Casalanza (died 1648), a Spanish nobleman, and confirmed by Pope Paul V. in 1617, and again by Gregory XV. in 1621, on each of which occasions its privileges were increased. In 1690 it was rewarded for its useful labours by the most important privileges of the mendicant orders. The Piarists are, like the Jesuits, a secular order, subject to rules. They also resemble the Jesuits in their costume, and in their devotion to the service of the church and to education, and have been the rivals of that order from the time of their institution. They soon spread themselves through the Catholic countries, particularly in the Austrian dominions, and became numerous and powerful, without subjecting themselves to the charge of ambitious views, and without meddling in political matters, as the Jesuits did. Many gymnasia and schools in Hungary and Poland are still under their direction. In Bohemia, Moravia, Silesia, and Austria they have some respectable colleges, and their services in the cause of education have undeniably been great. At present this order numbers about 2000 members, who are distributed over 200 establishments in the countries mentioned.

PIASSABA, PIAÇABA, or PIASSAVA, a strong vegetable fibre imported from Brazil, and largely used for making brooms. It is chiefly obtained from the Piassava Palm (*Attalea funifera*), but also, it is said, from other kinds of palm, as the *Leopoldinia piassaba*. The fibre proceeds from the decaying leaves, the petioles of which separate at the base into long, coarse, pendulous fringes. It is also called monkey-grass and para-grass.

PIASTRE, a name adopted by several European languages from the Italian (*piastra*, that is, 'metal plate'), and first applied to a Spanish coin, which, about the middle of the sixteenth century, obtained

almost universal currency, and was frequently imitated. In Spain itself the coin was called *peso duro*, or more usually simply *duro*, and sometimes *peso fuerte*. Its proper value was about 4*s.* 4*d.*, but its actual value varied considerably. In the states of America which were formerly Spanish colonies the piastre is usually called *peso* or *dollar*. The Italian piastre or *scudo* was originally coined in imitation of the Spanish piastre. Its value was different in different states. The name of piastre is still given by other European nations to the Turkish *gersh* (plural *gurush* or *grush*), which was originally worth about 3*s.* 6*d.*, but has now declined in value to about 2*d.* in Turkey and 2½*d.* in Egypt.

PIATRA, a town in Moldavia, on the Bistritsa, 53 miles south-west of Jassy. It has manufactures of paper, and a trade in cereals, cattle, horses, leather, tobacco, spices, &c. In the neighbourhood grows a wine which, if proper attention were given to its cultivation and preparation, would rival that of Tokay, but which is sold at a comparatively low price, as it it is neglected by the inhabitants. It is nearly all exported to Russia. Pop. 20,000.

PIAUHI, or PIAUHY, a province of Brazil, bounded north by the Atlantic, east by Ceará and Pernambuco, south by Bahia, and west by Maranhão; area, 81,755 square miles. Its coast-line is not above 10 miles in length, and it contains only one harbour, and that very indifferent, at the eastern mouth of the Parnahiba, which is the only river, and which during almost the whole of its course forms the boundary between this province and Maranhão. Towards its bed the surface has a general slope, and accordingly pours all its drainage into it by numerous tributaries, the most important of which are the Uruçuhi, the Gorguea, Piauhi, Coninde, an affluent of the Piauhi, Poti, and Longa. The climate is extremely warm. During the three hottest months of the year the streams and lakes are often laid completely dry. The surface, from its flatness, is well adapted for cultivation; and the soil, generally composed of alluvium, is of great natural fertility. Where a deficiency of moisture is not experienced, as on the banks of the larger lakes and streams, tobacco, rice, and the sugar-cane are successfully cultivated; and even in those districts which suffer most from drought, the rainy season lasts long enough for the growth of millet, haricot, manioc, and cotton. The province is not so densely wooded as is common within the tropics, many of the extensive plains having only a covering of shrubs or verdure. The various species of palm, however, are tolerably abundant, and no want is felt of timber for building and other ordinary purposes. The rearing of cattle, esteemed the best in Brazil, constitutes a principal source of wealth to the province. Horses also of an excellent breed are numerous, and furnish an important branch of traffic. The province contains an establishment for technical education, possessing workshops for tailors, shoemakers, tinsmiths, and other trades. The provincial assembly holds its sittings in Oeiras. Pop. (1882), 241,839.

PIAZZA, in architecture, is a portico, or covered walk, supported by arches. It properly signifies a square, or open place of any shape, in a city, and has derived its architectural meaning from the fact that in warm countries such open places are frequently surrounded by covered walks.

PIAZZA-ARMERINA, a town in the Kingdom of Italy, in Sicily, province of Caltanissetta, and 18 miles E.S.E. of the town of Caltanissetta. It is the see of a bishop, and the centre of an agricultural district. Pop. of the commune, 18,252.

PIAZZI, GIUSEPPE, an Italian astronomer, born at Ponte, in the Valteline, in 1746; in 1764, entered the order of the Theatines at Milan, and studied at Milan, Turin, and Rome, under Tiraboschi, Leseur, and Beccaria. In 1770 he was appointed professor of mathematics at the new university in Malta, on the abolition of which he returned to Italy, and in 1780 became professor of the higher mathematics at Palermo. Having induced the viceroy to establish an observatory there, Piazzi went to England and France to purchase the necessary instruments. The observatory was completed in 1789, and is described in Piazzi's Della Specola astronomica de' Registudj di Palermo (1792–94). His first observations were published in 1792. He soon after began his catalogue of stars, and dedicated the first, containing 6784 stars, to the Institute at Paris. January 1, 1801, Piazzi discovered the planet Ceres, in commemoration of which the King of Naples wished to strike a gold medal in his honour; but Piazzi preferred that the money should be applied to the purchase of instruments for the observatory. In 1814 he completed his second catalogue, containing 7646 stars. He had also been occupied in the reformation of the system of weights and measures in Sicily. The observation of comets he always considered as useless. In 1817 the king called him to Naples to examine the plan of the new observatory there. He was then appointed director-general of the observatories of Naples and Palermo. His last years were chiefly devoted to the subject of public education in Sicily. He died July 22, 1826. His Lezioni elementarj di Astronomia, his most important work after the catalogue of stars, was published at Palermo in 1817.

PIB-CORN. See HORNPIPE.

PIBROCH, a martial air played to the bagpipe by the Scottish Highlanders. Such airs are of a wild and irregular character, and upon Highlanders have always a stirring, often an almost magical, effect. Every clan had its own pibroch. See BAGPIPE.

PICA, a size of type. See PRINTING.

PICARD, JEAN, a French astronomer, born in 1620 at La Flèche, in the department of the Sarthe; died at Paris in 1682. He was of very humble parentage, and appears to have commenced life as a gardener; but having naturally a strong inclination for astronomy, availed himself of an opportunity with which an astronomer furnished him of becoming acquainted with astronomical instruments, and with such success that he ultimately became one of the best observers of his time. He took priest's orders, and officiated for some time at Rille, in his native department; but he first became known to the public in 1645, when he assisted Gassendi in observing the solar eclipse which took place in August in that year. In 1655 he became Gassendi's successor in the chair of astronomy in the Royal College of France. In 1666, when the Academy of Sciences originated, he was one of the eight persons selected by Colbert for the first members. The measurement of an arc of the meridian is the work by which Picard is now chiefly known. His arc, the measurement of which he commenced in 1669, extended between Amiens and Malvoisine. The result gave 57,060 toises for the length of the degree in that latitude, which has since been found to be only 14 toises too little. This measurement is historically important in the science of astronomy, as it furnished Newton with the means of verifying his theory of gravitation, for want of which verification he had not ventured previously to make it known.

PICARD, LOUIS BENOÎT, a French writer of comedies, born at Paris in 1769; died in 1828. Before he was quite eighteen he became an actor, making his debut at the Théâtre Louvois. Almost as early he began to write for the stage with success. About 1800 he became the manager of the theatre, continuing to perform and write at the same time.

He soon after (1806) withdrew from the boards, was admitted to the French Academy, and intrusted by government with the direction of the opera. While at the head of the opera he ceased writing, but in 1816 resumed the direction of the Théâtre Louvois, which had in the meantime been transferred to the Odéon, and again began to write. He died in 1828. Picard, on account of his skilful delineation of character, was called by the French *Le petit Molière*. He was the author of more than seventy larger and smaller pieces, besides several romances. In many of the smaller pieces he employed *collaborateurs*. His works were published in ten vols. at Paris in 1821–22.

PICARDS. See ADAMITES.

PICARDY, formerly a province of France, in the northern part of the kingdom, lying on the British Channel, to the north-west of Normandy, and south of Artois. (See FRANCE.) It was for some time in possession of the British crown. The patois of Picardy is one of three principal dialects of the *langue d'oil*.

PICCINI, NICCOLÒ, an Italian musical composer, born at Bari, in the Kingdom of Naples, in 1728; died at Passy, in France, in 1800. He was designed by his father, who was a musician, for the church, but soon displayed such a decided taste for music that he was placed at the Conservatory of Santo Onofrio, at the head of which was the celebrated Leo. After spending twelve years there, he left the conservatory, thoroughly grounded in the science of music, and animated with a glowing imagination, which wanted only an opportunity to show itself. He now began to compose comic and serious operas, chiefly for the stages of Rome and Naples, with such success that for many years he was without a rival in Italy. At last, in 1773, a coterie of enemies succeeded in causing one of his operas to fail at Rome, and in raising Anfossi to the place in popular favour which Piccini lost, and this so mortified the latter that he fell sick, and after his recovery determined to devote himself solely to the theatres in Naples. In 1776 he accepted an invitation, on very favourable terms, from the French court, and went to Paris. At that time, besides numerous oratorios, cantatas, &c., he had composed 133 operas. Being entirely ignorant of the French language, he received instruction from Marmontel, and with his assistance brought out the Roland of Quinault, which, notwithstanding the opposition of Gluck and his friends, was successful. Although Gluck and Piccini were personally reconciled, yet the war between their respective admirers continued (see GLUCK); and in order to compare their merits, the two rivals composed the same subject, Iphigenia in Tauris: in this contest Gluck had the advantage. He was appointed director of the Royal Singing School in 1782, but the revolution deprived him of his appointments, and he returned to Naples in 1791, where the king granted him a pension, and employed him on various occasions; but having become suspected of revolutionary sympathies he was exposed to much hard treatment, and finally returned to France in 1798.

PICCOLO (Italian, *little*), a small flute having the same compass as the ordinary flute, but pitched an octave higher.

PICCOLOMINI, a distinguished Siennese family, still flourishing in Italy in two branches. The two most celebrated members are:—1. ÆNEAS SYLVIUS BARTHOLOMÆUS, afterwards Pope Pius II. (See PIUS II.)—2. OCTAVIO, a grand-nephew of the first, born in 1599; died in Vienna in 1656. He early entered the Spanish service, but afterwards served in the armies of the German emperor, and became one of the distinguished generals in the Thirty Years' war. He was a favourite of Wallenstein, who intrusted him with a knowledge of his projects, when he purposed to attack the emperor. In spite of this he made himself the chief instrument of Wallenstein's overthrow, and after the latter's assassination (1634) was rewarded with a portion of his estates. After the battle of Nördlingen (September 7, 1634), in which the Swedes were greatly weakened, he advanced with Isolani through Würtemberg, over the Main. In the following year he was sent to aid the king of Spain against the French, and delivered the Netherlands from the hands of the latter. He was less successful against the Dutch. His further successful campaigns in the Thirty Years' war induced Philip IV. of Spain to beg the emperor to allow him to lead the Spanish armies. The request was granted, and as a Spanish general Piccolomini again distinguished himself in the Netherlands, against both the French and the Dutch. The King of Spain rewarded him for his services, by bestowing on him the Duchy of Amalfi. During the victorious advance of the Swedes in 1648 he was recalled by the emperor, and was appointed, with the title of field-marshal, to the command of the troops destined to oppose them. His military career was concluded after a short campaign in the same year by the Peace of Westphalia. He is one of the principal characters in Schiller's drama of Wallenstein, to the second part of which he gives the title. His son Max, who appears in the same play, is an invention of the poet's.

PICHEGRU, CHARLES, a French general, born at Arbois, in the department of Jura, in 1761. He had a good education, and was for some time a tutor at the College of Brienne, but soon exchanged this profession for that of a soldier. He was stationed at Besançon at the time of the outbreak of the French Revolution, and having placed himself at the head of the revolutionary movement in that town, was chosen the commander of a body of volunteers who went to join the army of the Rhine. In 1792 he held the rank of staff-major in that army, and was rapidly advanced to those of general of brigade and general of division, and in October, 1793, was appointed general-in-chief of the same army. Being unable with his inexperienced and undisciplined troops to meet the well-drilled forces of the enemy in the open field, he carried on the war by repeated skirmishes and partial attacks, and in this way gained such successes that in 1794 he was selected as the fittest man to command the army of the north, then beaten and demoralized. In his new command he showed not less capacity than he had done in his first. He defeated the enemy at Courtray, Menin, Hoogelede, reduced to subjection Bruges, Ghent, Antwerp, Hertogenbosch, Venloo, and Nijmegen, crossed the Maas and the Waal on the ice in the winter of 1794–95, subjugated Holland, and entered Amsterdam in January, 1795. Pichegru now returned to Paris to enjoy his triumph. He was now at the height of his fame, and was honoured by the Convention with the title of saviour of his country. The Jacobine insurrection of the 12th of Germinal (April 1, 1795) happening to break out when he was in Paris, he was ordered to suppress it. Soon after he set out to take the command of the army of the Rhine and Moselle, but in this post displayed none of his former energy. He had become disgusted by what he had seen at Paris with the anarchical state of affairs then prevailing in the capital, and allowed himself to be won over by the promises of Prince Condé to declare himself willing to bring back the Bourbons. The directory having obtained knowledge of his negotiations with Prince Condé, deposed him (1796), but being too weak to call him to account

for his conduct, offered him the post of ambassador to Sweden. Pichegru refused the offer and retired into private life. Having secured his election to the Council of Five Hundred he was chosen its president (March, 1797), and became the soul of the party hostile to the revolution. Having been proscribed in consequence of the events of the eighteenth Fructidor (September 4, 1791), he was transported to Cayenne, but managed to make his escape the year following. He repaired first to London, and thence to Germany, where he laboured for the ruin of the republic. In 1803 he was again in London, and then he allied himself with George Cadoudal, with whom he entered into a conspiracy to assassinate Napoleon. Having gone to Paris for the purpose, he was captured by the police, and committed to the Temple prison, where he was found strangled on the 6th of April, 1804.

PICHLER, KAROLINE, a German authoress, born at Vienna, September 7, 1769; died there July 9, 1843. Her maiden name was Karoline von Greiner. She appeared in literature as a poetess, dramatist, and novelist, but is only celebrated as a novelist. Her first novel, Olivier, was published anonymously in the Oesterreichisches Taschenkalendar in 1802. Lenore followed in 1804, and Agathokles in 1808. Having been recommended to popularize the history of her country, she in 1811 inaugurated a series of historical novels by the publication of the Graf von Hohenberg. The chief of the remainder of the series are Die Belagerung Wiens von 1683; Die Schweden in Prag; Die Wiedereroberung von Ofen, Henriette von England, and Friedrich der Streitbare. An edition of her collective works, embracing sixty volumes, was published at Vienna between 1820 and 1845.

PICK-AXE, an axe composed of a wooden handle and an iron head, which has two slightly curved prongs, one on each side of the handle, and forming together one piece. The pick-axe is employed in loosening the soil, in picking out pavement, &c.

PICKETS, in military affairs, sharp stakes varying in length according to the purpose for which they are used. When used for laying out ground they are about 3 feet long, and sometimes shod with iron; when intended for pinning the fascines of a battery, they are from 3 to 5 feet long. In the artillery pickets 5 or 6 feet long are used to pin the park lines; in the camp they are used about 6 or 8 inches long to fix the tent-cords, or 5 feet long in the cavalry camp to fasten the horses.

PICKLE-HERRING. See HARLEQUIN.

PICKLES, parts of vegetables preserved in vinegar, used to give zest to animal food. They are prepared by first washing the parts in clean water, then soaking for a few days in brine, afterwards drying them with a cloth or draining them, and finally putting them into the vessel in which they are intended to be preserved, and pouring in boiling vinegar until the vessel is quite full. Before the vinegar is poured in a few peppercorns, one or two blades of mace, a little ginger, or some other spice, may be added, or whatever spices are used may be boiled with the vinegar. When the vegetables that are to be pickled are naturally soft the vinegar is sometimes poured in cold. To preserve the colour of vegetables that are naturally green, the best means is to steep vine, cabbage, spinach, or parsley leaves in the vinegar. In many cases this is effected with much less trouble by boiling the vinegar in copper vessels, and thus forming an acetate of copper, or by directly adding that salt, which is green; but this practice is a very injurious one, as the acetate of copper is poisonous.

PICO, one of the Azores, so called from a very high mountain terminating in a peak. It lies to the south-east of Fayal, from which it is separated by a channel about 8 miles in width. The island is about 25 miles long, and has an average breadth of 10 miles. It is entirely composed of lava, originally so bare that earth had to be brought from Fayal to make a soil. Now the slopes are covered with various objects of cultivation, especially vines, which yield in an average year from 20,000 to 25,000 pipes of wine, which is chiefly exported, by way of Fayal, to the Antilles. The chief town is Villa-di-Laguna. Pop. 27,000. See AZORES.

PICO DELLA MIRANDOLA. See MIRANDOLA.

PICOLINE (C_6H_7N), a base, isomeric with aniline, prepared from coal-naphtha. It is a colourless, mobile liquid, possessing an intensely powerful odour; when inhaled through the nostrils it produces a bitter taste in the mouth and back of the throat. Picoline has an alkaline reaction; it boils at 135°. It forms a well-defined series of salts; and a series of substitution products is derived from this base. Picoline is also produced in the dry distillation of a number of animal and vegetable substances, such as bones, beans, cinchonine, peat, &c.

PICOTEE. See CARNATION.

PICQUET. See PIQUET.

PICRIC ACID ($C_6H_3N_3O_7$). This acid forms light yellow, strongly-shining laminæ, which have an exceedingly bitter taste. It is produced in many different ways and from many sources; from phenol (which see), by the action of nitric acid, a reaction which leads to the rational formula $C_6H_3(NO_2)_3O$, and the name trinitrophenic acid, for this body; from indigo also by the action of strong nitric acid; from silk, from aloes, from benzoin, &c. &c. Picric acid is a powerful dye-stuff; it is especially used for dyeing silk of a yellow colour. The colour resists the action of light very well, but is somewhat affected by washing with soap. As cotton, hemp, and flax are not dyed by picric acid, this substance may be used as a test for distinguishing those materials from silk and wool. Picric acid is monobasic, forming a series of *picrates* having the general formula $C_6H_2M(NO_2)_3O$, where M represents a monovalent metal.

PICROTOXIN ($C_{12}H_{14}O_6$), the poisonous principle of the seeds of *Cocculus Indicus* (*Menispermum Cocculus*). By exhausting the pulverized seeds with alcohol and decolourizing with lead acetate, picrotoxin may be obtained in colourless, needle-shaped crystals, which have an intensely bitter taste. Picrotoxin is tolerably soluble in water; it unites with various metallic oxides, forming uncrystallizable compounds. It is a poisonous substance.

PICTOU, a thriving commercial town in the northern part of Nova Scotia. It is well built, and has a safe and commodious harbour, with a lighthouse at the south side of its entrance. It is the resort of coasters from all parts of the Gulf of St. Lawrence, the eastern shores of Prince Edward's Island, and the north coast of Cape Breton. The coal-mines in its vicinity are very extensive, and the coal is excellent. Iron is also found and manufactured in small quantities, and there are extensive quarries of building stone. Coal is the chief export. In the year 1881–82 the total value of the exports amounted to £45,570; that of the imports to £67,303. Pop. in 1881, 3403.

PICTS, the name anciently given to the inhabitants of a large portion of the present Scotland. They are celebrated in Scottish history on account of the controversy which has long been waged as to their ethnological relations, and which is known as the Pictish question. The precise subject of controversy is whether they were a Celtic or a Teutonic

people. The materials on which the controversy is supported are very slender, from which it naturally follows, that, in spite of the great amount of learning and ingenuity that have been employed in it, it has led to equally slender results. It is not even known whether the name of Picti, by which the Romans designated this people, and which vernacular chroniclers of Scandinavian and Saxon origin corrupted into Pecht and Pechtar, was originally a Latinized form of the name which the people gave to themselves, or a descriptive appellation bestowed upon them on account of their habit of painting their body. The name is, at any rate, mentioned by Roman writers as an appropriate one, from which it would appear that they had the custom referred to, whether they got their name for that reason or not. On the supposition that the name is a native one numerous attempts have been made to connect them with some other people bearing a similar name, but none of these attempts has led to any satisfactory conclusion. The most audacious of them is that of Pinkerton, who attempted to identify them with the Peukini, a Scythian, and, as he thence assumed, Teutonic people, originally located about the mouth of the Danube. The name of this people thus failing to afford any trustworthy clue as to their ethnological identity, antiquarians and historians have sought for more light on the subject in the language of the people, in an etymological study of their geographical and biographical names, in the allusions made to them by early writers, and in the character of their remains; but these investigations have scarcely yielded any more information than the first. As to their language all that we know is that they had a language different from the Saxon or English, from the British, and from the Irish, or the language of the Scots of Dalriada, who were settled to the west of the Picts, and sufficiently different from the last-mentioned to make it necessary for the Scot, St. Columba, when preaching the gospel to the Northern Picts to make use of an interpreter, as he is mentioned on two occasions by his biographer Adamnan to have done. Of this language the sole relic that was known for a long time was the single word Paenfahel, which Bede states to have been the Pictish name of the western termination of the northern Roman wall, called in Saxon Peneltun; yet notwithstanding this that single word has been made the ground of many learned discussions, bearing a tolerably close resemblance to that between Monkbarns and Sir Arthur Wardour in Sir Walter Scott's Antiquary, where the former deduces from it a Gothic, and the latter a Celtic origin for the Picts. A few more Pictish words and syllables have since been brought to light through the labours of Dr. Skene, but little more has been gleaned from them than from the single word previously known. The attempts to draw any well-grounded inferences from the allusions to the Picts in ancient writers, and from the etymological study of the geographical names which were given, or may have been given, to the rivers, lakes, mountains, and localities in the region inhabited by them, or of the names contained in the lists of Pictish kings, have been equally fruitless; and the same has hitherto been the case with the ancient remains attributed to the Picts. It is thus apparent that there are not the means for definitively deciding the question either one way or the other; but it may be mentioned that the preponderance of opinion seems to be on the side of the belief that the Picts were a Celtic people, a conclusion which is favoured by the ease with which the Picts and Scots amalgamated into one after they were united under one king, in the middle of the ninth century.

The history of the Picts is wrapped in nearly, though not quite, as much obscurity as their ethnological character. One of the main causes of this obscurity is the irreconcilable differences between the various early Scotch chronicles, and it has now been shown that these differences arise to a large extent from wilful fabrication. In his recent publications, noticed at the end of this article, Dr. Skene has shown the motives and traced the history of the fictitious chronicles. The result of his researches is that the fabrications took place at the time of the disputes between England and Scotland as to the claim of the former to ecclesiastical and feudal supremacy over the latter. When the claim to ecclesiastical supremacy was that which was chiefly to be resisted, the Scotch chronicles are framed so as to support the ecclesiastical independence of the see of St. Andrews, which is done by throwing its foundation back from the eighth to the fourth century, and thus to a date antecedent to the foundation of the see of York, and altering the chronicles of the Scottish kings (which were already crowded with unconscious myths) so as to harmonize with this change. When, on the other hand, the main object of the fabrication was to maintain the Scottish claim to civil independence, the chronicles were framed so as to show the superior antiquity of the Scottish kingdom as compared with that of England, and this was done by placing the whole list of the Scottish kings of Dalriada, in Argyle, before the lists of Pictish kings, which made the Kingdom of Scotland date from 443 B.C. Finally, towards the close of the fourteenth century, Fordun appeared with a new chronicle, the main feature of which Dr. Skene has shown to be an attempt to weave the two sets of chronicles already existing into one.

The first mention that is known to have been made of the Picts occurs in a speech delivered in the year 296 A.D. by one Eumenius, on the occasion of the victory of Constantius Chlorus, afterwards emperor, over Allectus. They are again mentioned by Ammianus Marcellinus, in 360 A.D., along with the Scots, as laying waste the parts of the Roman province adjacent to their territory, and the earliest British chroniclers frequently speak of the Picts and their country Pictavia or Pictland. The region occupied by them appears to have embraced the whole of Scotland to the north of the Forth and Clyde, except the county of Argyle, where some isolated bands of Scots from Dalriada, in the north-east of Ireland, established themselves as early as the fourth century, and where they set up a separate kingdom in the beginning of the sixth. The earliest important historical fact connected with the Picts is the introduction of Christianity among them by the preaching of St. Ninian in the beginning of the fifth century, and by this time they were divided into two kingdoms, that of the Southern Picts to the south of the Grampians, having its capital at Forteviot, in Strathearn; and that of the Northern Picts, called by the Irish chroniclers Cruithne or Cruithnach, to the north of those mountains, having its capital at Craig Phadrick, and it was to the former of these that St. Ninian confined his labours. The kingdom of the Northern Picts did not receive Christianity till about the close of the sixth century, when it was introduced by St. Columba. This is almost the sole fact that has come down to us regarding the Northern Picts, although there is sufficient evidence to show that they continued to have a separate existence long after this, a thing which is at any rate probable enough, from the nature of the barrier which divided the two kingdoms. Somewhat more is known concerning the Southern Picts. In the seventh century their history is closely connected with that of Northumbria, the kingdom conterminous with theirs on the south. In

617 Edwin of Deira, the first Christian king of Northumbria, having slain Ethelfrid, the previous king, and driven his sons from the kingdom, these took refuge with the Picts, and one of them, Eanfrid, married a Southern Pictish princess. Their son Tolargan succeeded to the throne, and reigned till 657 or 658. Meanwhile the brothers of Eanfrid had recovered the throne of Northumbria, and one of them, Oswy, who happened to be king at the time of the death of Tolargan, shortly after that event, and probably taking advantage of some pretext which the relationship between the two afforded, invaded the Kingdom of the Southern Picts, and succeeded in establishing Northumbrian rule there. This Northumbrian supremacy lasted till 685, when Egfrid, who had meantime succeeded Oswy, attempted to push his conquests still further, and crossed the Tay with an army apparently pretty numerous. He had proceeded as far as Nechtan's-mere or Dunnechtan (identified with Dunnichen in Forfarshire) when he was met by the Picts, and sustained so crushing a defeat that the Picts not only recovered their independence, but even appear to have extended their frontiers for a time as far as the Tweed. The precise date of this event was the 20th of May, 685. During the Northumbrian domination the religious observances of the Anglican Church, which were the same as those of the orthodox church, had been introduced into the Kingdom of the Southern Picts, in place of those of the followers of Columba, which differed from those of the orthodox church as to the time of keeping Easter and the form of the tonsure, and which at some previous period had been extended from the Northern to the Southern Picts. After the expulsion of the Northumbrians the orthodox practices do not seem to have been altogether abandoned, or if abandoned for a time were restored early in the eighth century. This was done by Nechtan, one of the two best known kings of the Southern Picts. He applied for guidance in this matter to Ceolfrid, abbot of Jarrow, and acted so energetically on his advice as to expel the clergy who proved refractory from his dominions. He also founded a monastery at Abernethy, to take the place of that of Iona as the chief ecclesiastical authority for his kingdom. He reigned for eighteen years, at the end of which time he was defeated by Angus Macfergus, who, after an intermediate period of struggle, succeeded him. Angus was the most powerful of all the Pictish kings. After firmly establishing his sway over all the land of the Southern Picts, he extended it also over the Northern Picts, and finally overran and put an end to the kingdom of the Scots in Argyle (741), thus bringing for the first time the whole of Scotland to the north of the Forth and Clyde under one rule. He reigned for twenty years after this last conquest, dying in 761. After this the Picts disappear from history for the greater part of a century, and when they reappear they do so as forming part of a kingdom co-extensive with that of Angus, but ruled over by a Dalriad Scot, Kenneth Macalpin (843). It is not improbable that this monarch had hereditary claims to the throne that had previously belonged to the Picts. He is called the grandson of Aucha or Eocha, and it is said that this Aucha had married a Pictish princess named Ergusia, through whom Kenneth Macalpin inherited his title. A powerful current of tradition makes it not unlikely, however, that whether this king had any hereditary claim to the Pictish throne or not, he had to make good his position by force of arms. Many historians have contended, on the strength of the later chronicles, that the change of the royal house at this time was due to the complete conquest and almost the annihilation of the Picts by the Dalriad Scots; but an examination of older and more trustworthy documents has shown that this supposition must be abandoned, that the two peoples had been gradually prepared for union before it actually took place, that after Kenneth had established himself firmly on the throne, whether peacefully or by force, they lived together not as a subject and a conquering people, and that while the names of Picts and Pictland continued to be used more or less as general designations for the people and the country of the north of Scotland for more than a century after Kenneth's accession, those of Scots and Scotia do not come to be used in the same way till about two centuries after that event.

The most important works throwing light on the history of the Picts and the Pictish question, are the Life of St. Ninian, by Ailred of Rievaux, in Pinkerton's Ancient Lives of Scottish Saints; Adamnan's Life of St. Columba (edited by Dr. Reeves); O'Conor's editions of the Irish Annals (the most trustworthy early chronicles); Dr. Skene's Chronicles of the Picts, Chronicles of the Scots, and other early memorials of Scottish history, with a preface treating of the relations between the Picts and Scots (1867); the same editor's Four Ancient Books of Wales, with a preface which, among other matters, discusses the place of the Picts among the native races of Britain (1868); Fordun's Scotichronicon, edited and translated from the Wolfenbüttel MS. by the same scholar (1871–72); Celtic Scotland, by the same author (in 3 vols. 1876–81); Father Innes's Critical Essay on the Ancient Inhabitants of the Northern Part of Britain (1729); Pinkerton's Inquiry into the History of Scotland (1789); Ritson's Annals of the Caledonians, Picts, and Scots (1828); E. W. Robertson's Scotland under her Early Kings (1862); and Sculptured Stones of Scotland, edited for the Spalding Club by Dr. John Stuart (1856–67).

PICTS' HOUSES, a name given in Scotland to a kind of ancient underground dwellings otherwise called *earth-houses*. They are generally built in dry sloping ground, such as hill-sides or the banks of rivers, and usually consist of a chamber from 20 to 60 feet long, 4 to 10 wide, and 4 to 7 high, constructed of unhewn stones without cement, roofed with unhewn flags, and entered by a narrow doorway near the top. Stone implements, bones, ashes, &c., are found in them.

PICTURES, COPYRIGHT IN. This is now secured to British artists and other artists resident within the dominions of the crown, by Act 25 and 26 Vict. c. lxviii. (1862), which not only applies to paintings, but also to drawings and photographs. This act gives to the artist the sole right of copying, reproducing, and multiplying such paintings and drawings, and the designs thereof, or such photographs and the negatives thereof, for the whole of the artist's life, and to his heirs for seven years after his death. When a painting, drawing, or negative of a photograph is first sold or otherwise disposed of after its production, there must be a special agreement stating whether the copyright is retained by the artist, or made over to the purchaser or assignee. The penalty for the violation of such a copyright, is any sum not exceeding £10, and forfeiture of all the copies. A register of proprietors is kept at Stationers' Hall, and no penalty is recoverable unless the picture or other work has been registered.

PICUS, an old soothsayer or wood-deity in Italy, son of Saturn and father of Faunus, was beloved by the sorceress Circe, who changed him into a woodpecker because he would not return her passion. His wife Canens pined away into air from grief. Picus was represented with the head of a woodpecker (Latin, *picus*), and presided over divination.

PIDDOCK. See PHOLAS.

PIEDIMONTE D'ALIFE, a town in Italy, in the province of Terra di Lavoro, 19 miles north of Caserta. It has manufactures of cotton and paper, and there are copper-mines in the neighbourhood. Pop. 7073.

PIEDMONT (Italian, *Piemonte*), a department (*compartimento territoriale*) of Italy, bounded on the north by Switzerland, east by Lombardy and Emilia, south by Liguria, and west by France; area, 11,198 square miles. It derives its name, signifying 'foot of the mountain,' from its situation at the base of the loftiest ranges of the Alps, the Lepontine, and Pennine, which encircle it on the north and north-west; the Graian and Cottian Alps on the west, and the Maritime Alps and Apennines on the south. The space inclosed within these barriers forms one of the most beautiful and fertile portions of Europe, commencing on the north, the south, and the west in majestic mountains, and thence descending by magnificent terraces and finely-undulating slopes to the rich plains of the Po. To the basin of this river, and consequently to that of the Adriatic, all the surface belongs. Besides rising within Piedmont, and winding circuitously across its centre, the Po receives within it (besides numerous minor streams) on the right the Maira, Tanaro, and Scrivia; and on the left the Clusone, Dora-Ripaira, Dora-Baltea, Sesia, and Ticino, which last forms the eastern boundary of the province from the point where it issues from the Lago Maggiore to its junction with the Po. Few of these are of navigable importance; but from the extensive and skilful use made of them for purposes of irrigation, it is almost impossible to overrate the advantages derived from them. In every quarter they are seen acting as an essential agent in the production of most luxuriant crops of wheat, maize, rice, beans, hemp, and hay. In all of these Piedmont after fully satisfying its own wants has a large surplus for export. Wine also is abundantly grown, and vast numbers of cattle are reared both for fattening and the dairy. There is no region of Italy in which silkworms are more extensively reared. The value of the silk which is obtained from them, and which is mostly exported in the raw state, is estimated at about £1,000,000 annually. The most valuable minerals are iron and marble, but there are also mines of argentiferous lead and of copper. The manufactures consist of silk, woollen, cotton, and flax tissues, and there are great numbers of silk-mills. The exports are chiefly grain, cattle, silk, hides, wine, wool, and iron. The great body of the inhabitants profess the Roman Catholic religion; but the mountain districts have from time immemorial contained great numbers of Waldensians, attached to a purer faith, and well known throughout Europe for the cruel bigotry with which they have been hunted, and the heroic patience with which they have endured. Piedmont is divided into four provinces—Turin, Alessandria, Cuneo, and Novara. The chief town is Turin, which from 1860 to 1865 was the capital of the Kingdom of Italy. Pop. on the 31st of December, 1881, 3,069,188.

Piedmont corresponds to the western part of the Gallia Transpadana and the northern part of the Liguria of the Romans. The Salassi, who inhabited the north-western part of this district, were a very warlike people, and were frequently in conflict with the Romans. They were not finally subdued till the time of Augustus, when most of the inhabitants were killed in battle, and the remainder (about 36,000) carried off as slaves. Their chief town was then colonized by Roman soldiers of the prætorian guards, and received the name of Augusta Prætoria (Aosta). The tribe living between the Salassi and the Ligurians was the Taurini, and their chief town in the reign of Augustus was called Augusta Taurinorum (Turin). After the fall of the Roman Empire Piedmont passed into the hands of the Goths, and then into those of the Lombards, from whom it was taken by Charlemagne. On the establishment of the feudal system it was possessed at first by the Marquises of Susa, Ivrea, Montferrat, and Saluzzi. In 1042 it passed to the counts of Maurienne, of the house of Savoy, with which it has since remained. In 1424 it was erected into a principality, and in 1718 became a part of the Kingdom of Sardinia, which was formed in the reign of Victor-Amadeo II. Since that date it has shared the fortunes of that kingdom. See SARDINIA, SAVOY, and ITALY.

PIENO (Italian, full), in music, a word often used for *tutti*, *grande*, or *grossi*, to signify that all the instruments of an orchestra are to be employed; and sometimes with *coro*, as *pieno coro* (a full chorus).

PIEPOWDER COURT, or PIEPOUDRE COURT, a court formerly set up at fairs and markets in England for the summary administration of justice in cases arising there. It is also called the Court of Dusty Foot, which has the same meaning as piepowder (a corruption of the French *pied poudreux*), and probably got its name from the fact of its being chiefly resorted to by pedlars and wayfaring persons, to whom the name of *pieds puidreaux* was given in Old French.

PIERIAN, an epithet given to the Muses, from Mount Pierus in Thessaly, which was sacred to them, or from their victory over the nine daughters of the Macedonian king Pierus, who were changed into magpies for having dared to engage in a contest with them. Pierides was also one of the designations of the Muses, for the same reasons.

PIERRE, JACQUES BERNARDIN HENRI DE SAINT, a miscellaneous French writer, born at Havre in 1737; died on his estate at Eraguy-sur-Oise, Jan. 21, 1814. In his twelfth year he sailed with his uncle to the Island of Martinique. After his return he entered in 1757 the school of engineers (*école des ponts et chaussées*) at Paris. In 1760 he was sent as an engineer officer to Düsseldorf, but was dismissed for insubordination. He then went to Malta to receive an appointment which he had been promised as engineer to the Maltese knights, but soon returned to France. After remaining for a certain period in Paris, giving private instruction in mathematics, he went to Amsterdam, where he gained a living as a journalist. We next find him in the service of Catharine II. of Russia, where he remained eighteen months. He then joined the French party in Poland, was made prisoner by the Russians, released, and after residing in Warsaw, Dresden, Berlin, and Vienna, returned to Paris. He obtained a commission in the engineer corps stationed in the Isle de France, but in two years threw up his commission on account of some disputes in which he became involved, and returned to France. Here begins his literary career, for which his changeful life had furnished him with rich materials. His first publication was the Voyage à l'Isle de France, which appeared in 1773. In 1784 appeared his Études de la Nature, in five volumes. Louis XVI. now appointed him superintendent of the botanical garden and of the Museum of Natural History. His Paul et Virginie (1788) passed through fifty impressions in one year, and has been translated into almost all the languages of Europe (English by Helen Maria Williams). Napoleon conferred on him the order of the Legion of Honour, and Joseph Bonaparte granted him a pension of 6000 francs. St. Pierre was also the author of La Chaumière Indienne, Harmonies de la Nature, and several other works. The best edition of his whole works is that published at Paris in 1818–20, which has been several times reprinted.

The editor of this edition was Aimé Martin, who also wrote an Essay on the Life and Writings of Bernardin de St. Pierre.

PIERRE, St., a small island belonging to France, near the southern coast of Newfoundland, and immediately to the south-east of the Island of Miquelon, also belonging to France. The two together form one colony, which is under a commandant residing in St. Pierre. The inhabitants subsist entirely by the cod-fisheries and the industries connected with them, such as the preparation of cod-liver oil and the building of schooners and small boats, which are employed in the fishing. The average number of boats employed in the fisheries is about 600, the crews about 16,000. The surface of the island is bare and rugged, and there is nothing deserving the name of agriculture. The exports of the colony (including Miquelon) consist almost exclusively in the products of the fisheries, and the imports of articles of food and manufactured goods from France. The Islands of St. Pierre and Miquelon were first acquired by the French in 1763; and after being several times taken by the English and restored, were finally confirmed to the former at the general Peace of 1814. Fixed pop. of St. Pierre, 2583.

PIERRE, St., a town in the West Indies, capital of the Island of Martinique, on the north-west coast of the island. It is built upon a narrow strip of low land, and runs parallel to the beach of a circular bay. The hills behind almost overhang the houses, which are in general well built in a superior style of European architecture, and the shops are numerous and well stored. The town contains some fine churches, a botanic garden, and is well fortified. It is a very active seaport. The best anchorage in St. Pierre's road is at its southern part, where there are some steep cliffs and rocks. Fort Bourbon has a casemated barrack for 2400 men. Pop. 28,000.

PIERRE-LES-CALAIS, St., a town in France, in the department of Pas-de-Calais, forming part of the suburbs of Calais, with important manufactures of tulle, metal buttons, glazed hats, leather, beet-root sugar, and refined salt. Pop. (1881), 33,290.

PIERROT, a comic mask on the French stage. He is dressed like the harlequin, and according to the old type was a simpleton and a babbler, with occasional traits of wit, like punchinello. But the pierrot of the modern type, created by Gaspard Deburan at the beginning of the present century, is a cunning and shameless poltroon who seems incapable of any good feeling. He is pale, emaciated, and famishing in appearance, affects indifference to the action that is proceeding on the stage, but all the time is on the watch for an opportunity of secretly committing some piece of malice or roguery.

PIETISM, in German theology. The name of *pietists* was originally applied in derision to some young teachers of theology at Leipzig, who began in 1689 to deliver ascetic lectures on the New Testament (*collegia philobiblica* or *collegia pietatis*) to the students and citizens. The idea of imparting theological instruction in a popular way came from their friend and teacher Spener (the German Fénelon), who had held religious meetings in Frankfort from the year 1670, at which the laity prayed, and were allowed to ask questions, &c. The theology of the Lutherans at that time had become stiff and dogmatical, attacking unsparingly all other systems, and making the essence of theology to consist in doctrines. Spener and his friends were desirous of re-establishing a Christianity of love and charity, which should manifest itself in the life of the individual. The governments, however, in several places soon prohibited such assemblies, which in some cases may in fact have given rise to disorders. Pietism, however, did not expire; on the contrary, the practical principle that a pious life was better than erudition gave it much success. While on the one hand the Leipzig lectures were put a stop to as being hostile to good government, there was on the other hand a new university, that of Halle, founded (1695) under the influence of Spener and the pietists. The leading adherents of Spener were appointed its first professors, among them Francke, the founder of the celebrated Waisenhaus or orphanage at Halle. An austere, often sombre morality, a belief in a sudden regeneration by the operation of divine grace, private meetings for religious exercises, &c., distinguished the pietists, though they never formed a separate sect. But, like the systems of so many sects, originating from a sincere desire for some better means of quenching a religious thirst than the dogmas of the established church afforded, pietism in many cases degenerated by degrees into an ill-regulated religious excitement. The Jansenism and Quietism of France, and the Methodism of England, sprang from sources similar to those of the German pietism. The name of pietists is still given in Germany to that section of Protestants which inclines to the views of Spener. In the more recent period of religious history in Germany they have been found now in alliance with the orthodox party in opposition to the rationalists; and again holding a separate position, in conflict with both orthodox and rationalistic theologians. See Spener.

PIETOLA, a village in Italy, on the Mincio, about 6 miles south-east of Mantua, according to the traditions of the neighbourhood the birth-place of Virgil, which Silius Italicus calls *Andes*. A grotto in the vicinity is called *Virgil's Grotto*. The French laid out a public garden here, in which they erected a statue of the poet, but which was destroyed during the second siege of Mantua (1797).

PIETRA DURA, a kind of mosaic executed in Italy, and especially at Florence, in hard stones, such as topazes, garnets, carnelians, rubies, &c. Inferior kinds, in which imitation stones are used, are largely made in England (Derbyshire and elsewhere), as well as in Italy.

PIETRO DI CORTONA. See Cortona.

PIG. See Hog.

PIGAFETTA, Antonio, the companion of Magellan and the historian of his discoveries, was born at Vicenza towards the end of the fifteenth century. Inflamed by reading the accounts of the Spanish and Portuguese discoveries with a desire of visiting distant parts, he studied the mathematical sciences and navigation; and when Magellan was sent out by Charles V. to search for a western passage to the Moluccas, in consequence of the dispute between Spain and Portugal concerning the line of demarkation between their respective possessions (see Alexander VI.), Pigafetta obtained leave to accompany him, and thus took part in the first circumnavigation of the globe (1519–22). He kept a journal of the voyage, of which Ramusio gives an abstract in the first volume of his collection, and of which a complete edition was first published under the title Primo viaggio intorno al globo terracqueo (Milan, 1800), by Amoretti, who discovered a copy in the Ambrosian Library. A French translation by Jansen was published at Paris in 1801.

PIGEON, a genus of birds, forming the type of the family Columbidæ, but also representing in some systems of ornithology the type of a distinct section of the order of Rasorial or Gallinaceous Birds. The Pigeons or Doves as a group are distinguished from other Gallinaceous Birds, such as the Fowls, &c., chiefly and primarily by the conformation of the bill. The upper mandible is in them arched towards

its apex, and is of horny consistence, whilst a second curve exists at its base; this latter convexity being formed chiefly by a cartilaginous plate or piece covering the nostrils—which apertures open in its anterior portion. This cartilaginous portion may be invested by a soft skin, which is occasionally provided with a fleshy or warty prominence. The tarsi are short, and are generally covered with scales, but in some cases they may possess a feathery investment. The three front toes are in the majority of cases entirely disconnected; the outermost of these digits being occasionally united to the middle toe near the base. The hinder toe reaches the ground, being situated on the same level with the front digits. The toes are scaly at their upper portions, furnished with membranous lobes beneath, and are provided with short nails of curved shape. The quills of the wings are elongated. They are usually of pointed shape, and number ten in the primary series. The quills of the tail generally number twelve; but sixteen may be present. No accessory plumes are developed on the feathers of the Pigeons. The 'crop' in these birds is of large size, and of double conformation; the so-called 'pigeon's milk' consisting of the mucous secretion of the glands of the crop mixed with the softened food, which, being regurgitated from the crop, is used by the Pigeons to feed their young. The cæca of the intestine are of small size. The gizzard is of strong conformation.

In habits the Pigeons differ from the majority of Rasorial Birds in being arboreal in habits, perching upon trees, and building their nests in elevated situations. Their powers of flight are also greatly in advance of those possessed by Gallinacei as a rule; and they are also capable of running actively on the ground in search of food. The Pigeons also take water by immersing the bill, and by taking a continuous drink; instead of frequently sipping the fluid after the fashion of other Rasores. The young are heterophagous, that is, are entirely dependent upon the parents' care after being hatched. Both sexes incubate; and these birds generally pair for life; the loss or death of a mate being in many cases apparently mourned and grieved over, and the survivor frequently refusing to be consoled by another mate. The song consists of the well-known plaintive *cooing*. The Pigeons are distributed in every quarter of the globe, but attain the greatest luxuriance of plumage in warm and tropical regions.

The Pigeon family is divided into various groups, exhibiting greater or less variations in plumage and structure. The true Pigeons or Columbidæ are represented by the Stock Dove (*Columba œnas*) of the southern English counties, which has been credited with being the progenitor of the domestic pigeon. The Ring-dove or Cushat (*C. palumbus*) is the largest British species, and has a wide distribution in Britain, and over Europe generally. It is found in Madeira, North Asia, and Africa. The Turtle Dove (*C. turtur*), found in Britain in summer, and the Cape Turtle (*C. Capensis*), are also representative species. The Rock Dove (*C. livia*) forms a third species, from which the various domestic varieties have sprung. The Rock Pigeon is found in the northern parts of the eastern hemisphere. It builds in the holes and crevices of rocks, its food consisting of grains. It is, however, also said to feed on snails, &c. Each of the two broods produced annually includes a pair of young. The House Pigeons, Tumblers, Fantails, Pouters, Carriers, and Jacobins are the chief varieties of the Rock Pigeon, and are well known as forming some of the most elegant of domesticated birds. These birds and their varieties have been employed by Mr. Darwin (see his Origin of Species and his Animals under Domestication) to illustrate many of the points involved in his theory of 'descent by natural selection.' The Pouters are so named from their inflated crops; the Fantails from their expanded tail, consisting of no less than thirty-six feathers; the Jacobins from the presence of a ruff or hood of feathers on the neck and head; and the Tumblers, from their habit of tumbling over in the air whilst flying. The Carrier Pigeon (which see) exemplifies a striking development of the 'homing' faculty, possessed by Pigeons generally, through the exercise of which these birds are enabled to return to their native haunts from long distances and with great speed. Before the introduction of the telegraph these birds were—and indeed in some cases still are—employed in conveying intelligence from one town or place to another in cases where despatch and secrecy are required. The Passenger Pigeon of North America is described under the article of that name.

The *Treronidæ* or Tree Pigeons of India, the Eastern Archipelago, and Australia, are distinguished by the short stout bill, the mandibles being of nearly equal thickness, and both arched at the top. The inner toes are shorter than the outer digits, and the tarsi are feathered. They inhabit trees and subsist on fruits. The plumage in many forms of this group is brilliantly coloured.

The *Gouridæ* or Ground Pigeons, inhabiting the tropic regions of both Old and New Worlds, possess a straight slender bill, convex towards its tip. The tarsi are elongated. The toes are long, and are bordered with a membranous fringe. These forms, as implied by their popular name, are more typically terrestrial than the familiar or true Pigeons. They walk easily on the ground, and subsist on seeds, &c. They are said rarely to perch on trees. The Crowned Pigeon (*Goura coronata*) of the Eastern Archipelago averages a turkey in size. It is so named from the presence of a head-crest of narrow straight feathers. The general body-colour is a grayish-blue. The Nicobar Pigeon (*Callœnas Nicobarica*), inhabiting India, possesses plumage of brilliant colours. Its body-colour is a dark blackish purple; the neck-feathers being elongated, and possessing blue, red, and golden hues. The wings are coloured blue; the tail being white, and the back of a golden-green lustre. The tail-feathers resemble those of the Cock in their disposition. The Carunculated Ground Pigeon (*Geophilus carunculatus*) forms another species of the group. See Pl. CXLVI.–CXLVII.

PIG-IRON. See IRON.

PIGMENTS, materials used for imparting colour, whether by dyeing, painting, or otherwise. (See DYEING.) The colouring substances used as paints are partly artificial and partly natural productions. They are derived principally from the mineral kingdom; and even when animal or vegetable substances are used for colouring they are nearly always united with a mineral substance (an earth or an oxide), because by themselves they have no body, which they acquire only by a mixture with a mineral. In painting the colours are ground, and applied by means of some liquid, which dries up without changing them. The difference of the vehicle used with the method of employing it has given rise to the modes of painting in water-colours, oil-colours, in fresco, in distemper, &c. For oil-painting mineral substances are more suitable than lakes prepared with minerals, because the latter become darker by being mixed with oil. Among the mineral colours are flake white (carbonate of lead, with an excess of oxide), strontian yellow (chromate of strontian), cadmium yellow (sulphuret of cadmium), yellow, Oxford, Roman, stone, brown, orange, puce, purple, and a great variety of other ochres, which are all oxides

of iron; Jaune de Mars and Indian red (also oxides of iron), vermilion (bisulphuret of mercury), palladium red (ammonio-perchloride of palladium, ultramarine (a compound of silicate of alumina and silicate of soda with sulphuret of sodium, which produces a blue colour by reacting upon the other two constituents), chromium green (sesquioxide of chromium), terre verte (silicate of protoxide of iron), amber (an iron ore with manganese), asphaltum, &c. Flake white is the best of all white pigments for a vehicle of oil or resin, but both it and all other whites of lead, which are in other respects the best whites, have the defect of becoming blackened through exposure to the foul gases common to most domestic atmospheres. Pictures which have been deteriorated in this way can, however, be restored by being allowed to experience the action of a strong light in a pure atmosphere. The lake colours have tin or alum for their basis, and owe their tint to animal or vegetable colouring substances. Among them are the red lakes, prepared from madder (which are regarded as the most enduring), cochineal, and of inferior quality from Brazil wood; the yellow from fustic, weld, &c.; the brown (Vandyke, Cappah, Rubens, Cassel, and Cologne browns) from various decomposed vegetable matters mixed with bituminous matter. Indigo is a purely vegetable colour, as is also blue-black, which is obtained from burned vine-twigs. Ivory black is a purely animal colour, being nothing else than burned ivory. In staining porcelain and glass the metallic colours which are not driven off by heat and are not easily changeable are used. Gold containing tin gives a purple, nickel a green, cobalt a blue, iron and manganese black, uranium yellow, chrome green.

PIGMY. See PYGMY.

PIGNUT. See BUNIUM.

PIKE, a genus of fishes belonging to the order Teleostei, and included in the Malacopterous division of the order. The *Malacopteri Abdominales*, or section to which the pikes belong, includes those fishes which possess ventral fins placed towards the hinder aspect of the body. The Pikes form the types of the family Esocidæ, in which group the body is lengthened, flattened on the back, and tapering abruptly towards the tail. One dorsal fin exists, this structure being placed far back on the body, and opposite the anal fin. The lower jaw projects, the biting edge of the upper jaw being formed by the maxillary and intermaxillary bones. Teeth are present in plentiful array, and are borne by almost every bone entering into the composition of the mouth. The body is clothed with *cycloid* scales, or those of a simple rounded variety. The pyloric cæca found attached to the stomach of most fishes are wanting in the Esocidæ. The pikes inhabit the fresh-water lakes and rivers of temperate climates. The Common Pike (*Esox lucius*) occurs in the rivers of Europe and North America. It is fished chiefly for the sake of its flesh, which is accounted exceedingly wholesome. The pikes form the tyrants of their sphere, being the most voracious of fresh-water fishes. They feed upon smaller fishes, upon frogs and other inhabitants of the rivers; but young ducks and other aquatic birds have been known to be dragged below the water and devoured by these fishes. The perches are said to escape the pike's attack from the presence of their spiny dorsal fins. When fully grown the pike may attain a length of 5 or 6 feet, and there are numerous instances on record in which these fishes have greatly exceeded that length. Of this description was the monster pike caught at Kaiserslautern, near Mannheim, in Suabia, in 1497, which measured 19 feet, and weighed 350 lbs. This same pike had attached to it a copper ring, on which an inscription bore that the fish had been placed in the water by the Emperor Frederick II. on October 5th, 1230. This date made the fish at the date of its capture to have been at least 267 years old. These fishes grow very rapidly. (See Pl. CV.–CVI. fig. 9.)

The Sea Pikes (*Esox belone*), also known as spit-fishes, gar-pikes, gar-fishes, and bill-fishes, are also included in the family Esocidæ. The body is long and of very slender conformation. It is covered with minute scales. The head is smooth, the jaws being elongated to form a slender beak-like structure. An entire dorsal and anal fin exists. (See Pl. CIII.–CIV. fig. 14.) The Saury Pike (*Scomberesox saurus*) resembles the gar-pike in general conformation, but possesses the dorsal and anal fins in the shape of a number of divided 'finlets.'

The Bony Pike (*Lepidosteus osseus*) of North American lakes and rivers belongs to an entirely different order of fishes—that of the Ganoidei. It has therefore no structural relations with the ordinary and common pikes. (See BONY PIKE, and Pl. CI.–CII. fig. 9.)

PIKE, a weapon much used in the middle ages as an arm for infantry, and still sometimes used by irregular and hastily armed troops. It was from 16 to 18 feet long, and consisted of a pole with an iron point. (See LANCE.) Men armed with it were called *pike-men*. After the invention of guns they gradually fell into disuse. The Prussian Landsturm was armed with pikes in 1813, to be used in case no better arms were to be had. The Swiss first substituted the halbert for the pike towards the fifteenth century. For some time every company in the armies of Europe consisted of at least two-thirds pike-men and one-third harquebusiers. Gustavus Adolphus, the great improver of the modern art of war, about 1630 omitted the pike-men in some regiments entirely. The invention of the bayonet still more effectually drove it out of use.

PIKE'S PEAK, one of the highest summits of the Rocky Mountains (11,497 feet), in the centre of the state of Colorado. It was discovered by General Pike in 1806. It abounds in rich gold-bearing quartz.

PILASTERS, square columns usually set in a wall from which only one-fifth or one-fourth of their thickness stands out. Their parts are the same as those of ordinary columns. See COLUMN.

PILATE, PONTIUS, the sixth Roman procurator of Judæa. He succeeded Valerius Gratus in A.D. 26. Nothing is known of his early history. He was a narrow-minded and impolitic governor, and at the very beginning of his term of office led to commotions among the Jews at Jerusalem, who had lived in perfect quietness for twenty years previously. He brought the Roman troops from Cæsarea, which was almost a purely Roman town, and where, accordingly, their presence was not likely to irritate the people, with whom they came little in contact, to Jerusalem, and endeavoured to introduce into the same city the Roman standards with the image of the emperor, in violation of the Jewish usages. He also appropriated the *corban*, a sacred revenue derived from the redemption of vows, to defray the cost of an aqueduct which he built to supply the city with water, and put to death some Galileans in the midst of the sacrifices, which latter act brought upon him the hostility of Herod, tetrarch of Galilee. When Christ had been condemned to death by the Jewish priests, who had no power of inflicting capital punishments, he was carried by them to Pilate to be executed. Pilate, seeing nothing worthy of death in him, sent him, as a Galilean, to Herod, who, however, sent him back to Pilate. Yielding to the clamours of the Jews the Roman

governor finally ordered Jesus to be executed, but permitted Joseph of Arimathea to take his body and bury it. Pilate was afterwards removed from his office by Vitellius, prefect of Syria (A.D. 36), and, according to tradition, was banished by Caligula to Vienna (Vienne), in Gaul, where he is said to have died or committed suicide some years after. The Acts of Pilate, written in Greek, as well as two Latin letters purporting to have been written by Pilate to the emperor, are spurious.

PILATUS, MONS, a mountain in Switzerland, on the borders of the cantons of Lucerne and Unterwalden, south of the town of Lucerne and west of the Vierwaldstättersee. Its loftiest peak, the Tomlishorn, attains a height of 7116 feet. Formerly its ascent was dangerous and rarely attempted, but a convenient path up it having been made in recent years it has become almost as great a favourite with mountain climbers as the Rigi on account of the imposing views of the Bernese mountain scenery obtained from various points. Mons Pilatus is associated in the imagination of the people with more legends than any other locality in Switzerland. Its ravines are popularly believed to be the haunt of dragons and goblins, and the mountain itself is supposed to have got its name from Pontius Pilate, who, smitten by remorse for the share that he had in the death of Christ, is believed by the inhabitants of that district to have put an end to his life by plunging into a gloomy lake which exists on the summit of the mountain. Superstition adds that a human figure is sometimes seen to rise from this lake and go through the operation of washing his hands, after which a mist gathers about the lake and gradually envelops the whole mountain, presaging a storm. Reference is made to this legend in the beginning of Scott's Anne of Geierstein. Some have supposed that the name of the mountain is really a corruption of *mons pileatus*, that is, 'hatted mountain,' a name which would be explained by the fact that it is frequently seen capped with clouds, but the true meaning of the name appears to be 'pillar mountain,' from the Latin *pila*, a pillar.

PILCHARD (*Clupea pilchardus*), a species of fishes included in the family and genus of the Herrings (Clupeidæ), and popularly known as the Gipsy Herring. The pilchard closely resembles the herring, but is of smaller size. As in the latter fishes the body is compressed and covered with large cycloid scales, which are readily removed. The upper lip is entire, the mouth being of moderate size. The pilchards, like the herrings, were formerly accounted migratory fishes, in that they retreated to the northern or Arctic seas during the summer and appeared round the British coasts in winter and spring. The pilchards, however, have been ascertained to frequent the coasts of Britain all the year round, and they may therefore be accounted native fishes. The usual spawning time is October, although the pilchard has been known to deposit eggs in May. Mr. Couch and other authorities maintain that these fishes breed once a year only. The food consists chiefly of Crustacea and analogous organisms. These fishes are found in greatest plenty on the southern coasts of England, the Cornwall pilchard fisheries being those best known and most celebrated. The fishery is more or less continuously carried on, but the month of July appears to be that in which the operations proceed with the greatest vigour. Shoals of pilchards then appear, including immense myriads of fishes, which are taken by means of the 'seine net'—a contrivance by means of which the shoal is surrounded by nets, after the fashion of a huge pocket, the limits of which are gradually lessened as the net is worked towards shallow water, the fish being taken out by the 'tuck net' as the tide recedes. Watchers, locally known as 'huers,' are stationed on heights and rising ground to inform the fishermen waiting in their boats below of the approach and locality of the pilchard shoals. The pilchards are packed in hogsheads, which each contain about 3000 fishes. Upwards of 10,000 such hogsheads have been filled in a single day's fishing at one port. These fishes are salted and cured, and are then piled into great stacks, from which a valued oil exudes. They remain four weeks in these stacks, and are then washed to free them from the oil, packed in barrels, and afterwards exported. The pilchards are chiefly consumed in Spain, Italy, and France during Lent and other fasting seasons. Of late years quantities of pilchards are preserved in oil, after the fashion of *sardines*, and exported as articles of food and as table delicacies, preserved in hermetically-sealed tins. Many of the commercial 'sardines' are in reality pilchards, the sardine (which see)—*Clupea sardina*—being also included in the Herring genus. (See Pl. CV.–CVI. fig. 3.)

PILCOMAYO, or ARAGUAI, a river in South America, rises in Bolivia, on the eastern declivities of the Andes, near lat. 19° S.; lon. 67° W., from which point it flows S.S.E., passing a little to the south of Chuquisaca under the name sometimes of the Cachimayo to about lat. 20° 40° S.; lon. 62° 53° W., where it is joined by the Pilaya; thence it flows south-west and S.S.W. across the Gran Chaco, in La Plata, and falls into the Paraguay, about 6 miles below, or south of Asuncion; lat. 25° 20′ S.; lon. 57° 40′ W. Its entire length is between 700 and 800 miles. On account of its shallowness during the dry season and the great current in its narrow parts it does not appear likely to become usefully navigable. About 100 miles from its mouth it divides into two branches, the north or main stream, called Pilcomayo or Araguai Guazu, and the south Araguai Mini; the latter enters the Paraguay by two mouths, 24 miles apart, and the most northern one 9 miles south from the mouth of the main stream.

PILES. See HEMORRHOIDS.

PILES, in works of engineering, are used either for temporary purposes or to form a basis for permanent structures. In the former case they are usually squared logs of wood sharpened at the point, which is sometimes protected with an iron shoe to enable it to penetrate the harder strata which it may meet with in being driven into the ground. The method of placing them is by means of a heavy weight which is raised to a height and then allowed to fall perpendicularly on the top of them. Steam is now generally employed to raise the weight in this operation. (See STEAM-HAMMER.) If while being driven into the ground the piles should manifest signs of splitting at the top they are protected by iron rings. The most usual purpose to which piles are applied in temporary structures is to make coffer-dams. They are driven close together in a circle round any part where engineering operations are to be carried on below the level of the surrounding water. When the circle has been completed the water is pumped out of the inclosed space, and the operations, such as laying the foundations of piers, abutments, &c., can then be performed on dry land. When the pressure outside is greater than a single row of piles is able to resist then a double row is made with an intervening space of 3 feet or more, which is filled up with clay, sand, and other materials well rammed in, or, to use the technical term, puddled. The permanent purposes for which piles are employed are various, but in all cases the object is to secure a firm foundation in a loose or swampy soil. In these cases the piles used are for the most part of cast-iron, sometimes solid

and sometimes hollow. The method of driving them is generally the same as with wooden piles, but in two kinds of piles special methods are used. The one of these is the screw-pile, invented by Mr. Mitchell, which consists of a long shaft of malleable iron, with a broad disk at the foot made on the under side in the form of a screw. This kind of pile is inserted in its place by means of a capstan, which works the pile into the ground like a screw-driver. Piles of this kind are found very useful in loose and shifty soils. The other kind is that patented December 5, 1843, by Dr. J. L. Potts. His pile is hollow, and is sunk by having the air within it exhausted by an air-pump, which draws the sand and water up from the bottom of the pile and conveys it to the receiver of the air-pump. As the sand is removed in this way the pile continues to sink until it reaches a solid foundation. If a single pile is not long enough for this purpose another may be fitted into the top of the first, and this may be repeated as often as is necessary. Piles of this description have been used with success to form foundations for lighthouses on sand-banks, as on the Goodwin Sands, where they have been sunk to a depth of 75 feet.

PILEUS. See FUNGI.

PILGRIMAGES. The practice of making pilgrimages to places of peculiar sanctity is as ancient as it is wide-spread. The ancient Egyptians and Syrians had privileged temples, to which worshippers came from distant parts. The chief temples of Greece and Asia Minor, those of Athena at Athens, of Artemis at Ephesus, Zeus at Olympus, Hera at Samos, Aphrodite at Amathus, Paphos, Cnidos, and Cythera, Æsculapius at Epidaurus, swarmed with strangers, whose object in visiting these shrines was the same as that of Christian pilgrims in visiting Jerusalem, or of Mohammedans in visiting Mecca. The Jews likewise were required by the Mosaic law to go up to Jerusalem once a year, at a fixed time, to hold the feast of the passover; and that also was a kind of pilgrimage. But it is in Christianity and Mohammedanism that the practice has attained its greatest development. The first Christian pilgrimages were made to the graves of the martyrs. Helena, the mother of Constantine, made a journey to Jerusalem to visit the grave of Christ, and her example found many imitators. St. Augustine describes the tomb of St. Stephen as thronged with pilgrims, and various other early Christian writers bear similar testimony. Indeed by this time (end of fourth and beginning of fifth century) the custom had become so general as to lead to abuses, and St. Jerome and Gregory of Nyssa, both of whom lived about the same time as St. Augustine, or rather earlier, zealously endeavoured to check the practice as tending to great moral corruption, an objection that has always been made to pilgrimages when they have become common and are undertaken in large promiscuous assemblies. Throughout the middle ages, and especially about the year 1000, the religious fervour of the people manifested itself in numerous pilgrimages, especially to Jerusalem. At that time the Holy Sepulchre was in the hands of the Saracens, who had at first treated the Christian pilgrims, from whom they derived considerable profit, with lenity; but from about the beginning of the tenth century, when Jerusalem came under the power of the fanatical sect of the Fatimites, the pilgrims were made the victims of all forms of outrage. The continuance of this treatment, in the course of about two centuries, gradually produced such a spirit of indignation throughout the Christian world as prepared the minds of the people for those expeditions (the Crusades) for the recovery of the Holy Sepulchre, which were themselves nothing else than gigantic armed pilgrimages, and which also had a powerful effect in stimulating the desire of making pilgrimages to the Holy Sepulchre among those who did not join the Crusades, and at times when no crusade was in progress. But the Holy Sepulchre was not the only goal of Christian pilgrims. Pilgrimages were performed in the middle ages to many different places. Some spots, however, attracted a much larger concourse than others, the credulity of the time associating with them peculiarly great or numerous miracles, or peculiarly extensive indulgences being granted to the pilgrims who visited them. The shrine of Our Lady of Loretto, near Rome, that of St. James of Compostella in Spain, of St. Martin of Tours in France, were all sacred spots to which, from the tenth to the thirteenth century, and even much later, pilgrims resorted in innumerable crowds; and from the end of the twelfth century the shrine of St. Thomas Becket at Canterbury had the same honour in England. The following instance will show to what extent pilgrimages even to distant places were performed as late as the year 1428. At that date there went to the shrine of St. James of Compostella in Spain, from London, 280 pilgrims; from Bristol, 200; from Weymouth, 122; from Dartmouth, 90; from Yarmouth, 60; from Plymouth, 40; from Exeter, 30; from Liverpool, 24; and from Ipswich, 20—in all 866 pilgrims from nine towns. After the Reformation the practice of making pilgrimages fell more and more into abeyance, and the spirit which led to it seems almost to have become extinct among Christians, although there are still occasional outbursts of it in the Roman Catholic communion, as in the year 1825, when Leo XII. proclaimed a jubilee, and large numbers of pilgrims flocked to Rome from all parts of Christendom; and again in France in 1872, and more especially in 1873, when various sacred localities in that country, but above all Paray-le-monial, were visited by pilgrims from all parts of France, and even from foreign countries, including England. These outbursts, however, are transitory and local, and comparatively weak.

During the middle ages, when pilgrimages were at their height, it is acknowledged that they were to a great extent noxious in their effects. The plea of being about to undertake a pilgrimage to some honoured shrine was made by the poor the excuse for mendicancy, by which they often amassed considerable sums of money, which were nearly as often squandered at Rome, or whatever other place the pilgrims might be destined for, in all kinds of excesses. On the other hand, it has often been pointed out that they served as a great means of communication between different nations, and thus promoted commerce and the diffusion of many arts and improvements.

For Mohammedans the great place of pilgrimage is Mecca, the birth-place of the founder of their religion, and the place where stands the Kaaba, or sacred altar, which is believed by Mohammedans to have been originally built by an angel, and which made Mecca the resort of Arabian pilgrims long before the time of Mohammed. Every year just before the feast of Bairam large caravans arrive at Mecca from all quarters. The persons who join these caravans have usually two objects in view—first, that of performing a religious duty, and second, that of doing some business; for these pilgrimages to Mecca serve commercial purposes to a much larger extent than those of the Christians in the middle ages. As much licentiousness is said to prevail in these Mohammedan assemblies as ever disgraced the Christian pilgrimages. Among the Hindus and the Buddhists also the practice of performing pilgrimages largely prevails. In India the principal resorts of pilgrims are

the subterranean temple of the island of Elephanta, off the Malabar coast; the pagoda of Juggernauth, in the province of Orissa; and the temple of Ellora, in the Nizam's Dominions. Among the Buddhists certain pagodas in China, and the most revered monasteries of the adherents of Lamaism in Tibet and Tartary, are visited by numerous pilgrims.

PILLAR. See COLUMN.

PILLAR-SAINTS. See STYLITES.

PILLAU, a seaport of East Prussia, 25 miles W.S.W. of Königsberg, at the southern extremity of a narrow peninsula formed by the Baltic and the Frisches Haff. The port is safe and commodious, and all vessels going to Königsberg or Elbing stop here. It is connected with Königsberg by railway. A fort protects the place. Much fishing is carried on here. Pop. (1880), 3225.

PILLIBHIT, or PILLIBHEET, a town in India, in the district of Bareilly, in the North-west Provinces, 802 miles north-west from Calcutta, on the Gurrah, is the entrepôt for an extensive traffic between the upper and lower country, more especially for rice, which is celebrated over India for its whiteness and fine flavour. It is grown in the south of Kumaon, and receives its name from being brought to Pillibhit for sale. Pillibhit contains government horticultural gardens, and a beautiful mosque built by Hafez Rehmut, a Rohilla chief. Pop. 30,000.

PILLNITZ, a palace of the King of Saxony, on the right bank of the Elbe, 7 miles from Dresden. The court remains here annually for some time. Its situation is very beautiful. In history Pillnitz is famous for a meeting of the Emperor Leopold II., Frederick William II. of Prussia, the Count of Artois, the ex-minister Calonne, and several other personages, from August 25 to 27, 1791. A treaty of offensive alliance was not concluded, but preliminaries were agreed on for a defensive alliance between Austria and Prussia, which was settled at Berlin, Feb. 7, 1792. The French were greatly irritated by this convention, which they considered as the basis of the coalition of Europe against France.

PILLORY, a frame of wood erected on posts, with movable boards, and holes through which were put the head and hands of a criminal for punishment. In this situation criminals in Britain were formerly often exposed to the outrages of the mob in a way inconsistent with any rational notions of punishment. Those who were offensive to the crowd were in no small danger from the missiles by which they were assailed. The culprit was allowed to make speeches, defending himself and attacking his enemies. In 1816 this punishment was abolished in all cases except that of perjury, and it has since been abolished altogether (by act 1 Vict. cap. xxiii., June 30, 1837).

PILLS, medicines made up in globules of a convenient size for swallowing whole. Their ordinary weight is 5 grains. Some vegetable substances used as medicines may be made into pills without the addition of any other material, but usually the substances having medicinal properties are not of the proper consistence to be made into pills by themselves, and require the addition of some other material, which is called an excipient. The usual excipients are bread-crumbs, hard soap, extract of liquorice, mucilage, syrup, treacle, and conserve of roses. The last two are the most valuable, preserving the proper consistency of the pills for a very long time. The materials of which pills are made are mixed together in a mortar until they are perfectly homogeneous, and are afterwards divided into pills with instruments devised for the purpose. To prevent them from adhering to one another, as well as to some extent to conceal the taste, they are covered with some fine powder, such as liquorice powder, wheat flour, fine sugar, and on the Continent lycopodium, which is very much used there. Instead of this powder pills sometimes receive a thin coating of gold or silver. Pills are a highly suitable form for administering medicines which operate in small doses, or which are intended to act slowly, or not to act at all until they reach the lower intestines, and in some other cases.

PILOT and PILOTAGE. A pilot is a person qualified to navigate a vessel within a particular district. The pilots of the United Kingdom are formed into associations at different places by ancient charters of incorporation, or by particular statutes. The principal of these associations are the Brotherhood of Trinity House of Deptford Strond; the Fellowship of the Pilots of Dover, Deal, and the Isle of Thanet, or the Cinque Port Pilots; and the Trinity Houses of Hull and Newcastle. The law relating to pilots and pilotage is contained in acts 16 and 17 Vict. cap. cxxix.; 17 and 18 Vict. cap. civ. (Merchant Shipping Act of 1854), Pt. v.; 25 and 26 Vict. cap. lxiii. s. 39–42; 35 and 36 Vict. cap. lxxiii. s. 9–11; and 36 and 37 Vict. cap. lxxxv. s. 19. The Trinity House of Deptford Strond is intrusted with the general regulation and superintendence of pilotage for the United Kingdom, and has in addition the entire administration within certain districts. These are, 1st, the London District, comprising the Thames and Medway up to London Bridge and Rochester Bridge respectively, and the seas or channels leading thereto from Orfordness on the north to Dungeness on the south; 2d, the English Channel District, from Dungeness to the Isle of Wight; 3d, the Trinity House Outport Districts, which consist of those for which no particular provision is made by any act of Parliament or charter. It is compulsory upon all vessels above 60 tons burden, except coasting vessels not carrying passengers, ships bound to Boulogne or to any place north of Boulogne, stone-laden ships from the Channel Islands, and ships navigating within the limits of the port to which they belong, to have on board, within the London District and the Outport Districts of Trinity House, a pilot qualified to act within the limits of such districts, unless the vessel be merely passing through these limits without loading or unloading at any port within them. In the districts beyond the administration of the Trinity House of Deptford Strond the obligations to and exemptions from compulsory pilotage which existed before the Merchant Shipping Act of 1854 were continued by that act; but the various pilotage authorities were empowered, with the sanction of an order in council, to make new exemptions or extend those already in use. Pilotage authorities may also, with the same sanction, alter and reduce the rates of pilotage, arrange the limits of pilotage districts, and make by-laws for various other objects; but if any such by-law, or any pilotage regulation in force previous to the passing of the act, is appealed against by the majority of the pilots, by the local marine board, or, where there is none, by six masters, owners, or insurers of ships, it may be revoked or altered by the board of trade. The board of trade may also appoint a new pilotage authority for a port under the jurisdiction of the pilotage authority of another port, unless that pilotage authority happen to be the Trinity House of Deptford Strond. Every qualified pilot on his appointment receives a licence for a particular district from the pilotage authority of that district. Masters or mates of any ship may, upon giving due notice, be examined and passed by the pilotage authorities, and receive pilotage certificates. In this case they must be renewed every year. Further, any master or mate of a ship may obtain from the board of trade, after examination, a certificate to the effect that he is authorized to pilot any

chip or ships belonging to the same owner of and under a certain draught of water. Any qualified pilot who keeps, or is interested in keeping, a public house, or in selling wine, spirits, tobacco, and tea; or who commits any fraud against the customs or excise, or is guilty of corrupt practices as to ships, cargoes, crews, or passengers; who lends his license, acts as pilot whilst suspended or when drunk, causes unnecessary expense to enhance his own or some one else's gain; declines, without reasonable cause, to go off when signalled for or required; unnecessarily cuts or slips a cable; refuses to conduct a ship into port, except on reasonable ground of danger to the ship; or leaves the ship of which he is in charge, without the master's consent, before the service for which he was hired has been performed—renders himself liable to suspension or dismissal, as well as to a penalty not exceeding £100, in addition to damages to the persons aggrieved. Pilot boats must also be approved and licensed by the pilotage authorities. They must be painted black outside, and have the name of the owner and port in three-inch letters on the stern, number of license on the bows, and a large flag with the upper half white and the lower half red; and whenever a pilot is carried off to a ship in a boat not belonging to the pilotage service he must exhibit a pilot's flag. Pilotage fees depend on the draught of water of the ship piloted, and for vessels with a large draught of water are very much higher than for those with a small one. In Britain no owner or master of any ship is answerable to any person for any loss or damage occasioned by the fault or incapacity of any qualified pilot acting in charge of such ship within any district where the employment of such pilot is compulsory; but the pilot must not be interfered with in the discharge of his duties. Other maritime countries have also passed laws to regulate the pilotage of vessels. In the United States each individual state makes its own regulations as authorized by acts of Congress. The most important body of pilots in the United States are those under the pilot commissioners of New York. The master of a vessel with a pilot on board has still the management of the vessel, and sees that she is kept in the course the pilot directs. A master refusing to take a pilot vitiates the insurance on the vessel.

PILOT FISH (*Naucrates*, or *Scomber ductor*), a genus of Teleostean fishes included in the Scomberidæ or Mackerel family, and sometimes included in the same genus (*Scomber*) as the Mackerel itself. These fishes derive their popular name from their habit of following ships for long distances, led probably by the expectation of food being thrown overboard. It is also credited with leading sharks towards food, being frequently seen accompanying the larger fishes, although observers have stated that they have noticed sharks prevented from seizing a bait by several pilot fishes, and that when the shark had actually seized the morsel the smaller fishes clung to the shark's body as it was being pulled out of the water. The ancients credited the pilot fishes with the labour of directing the mariner in his proper course when he had lost reckoning of his way. Probably a similar instinct and desire for food more than any other or more mysterious relationship causes the association of these fishes with the sharks. The average length is about 12 inches. In general form it resembles the mackerel. Its colour is a silver gray, merging into blue on the back, whilst the body is marked by five encircling bands of a dark blue colour. One dorsal fin exists, and free spines exist before this and also before the anal fin. Both the upper and lower aspects of the tail are 'keeled,' that is, possess a cartilaginous ridge.

PILPAY, or BIDPAI, the reputed author of a collection of fables which have been circulated for nearly 2000 years in numberless translations and redactions, among all the nations of the East and West. The careful investigations of Colebrooke, Wilson, Sylvestre de Sacy, Loiseleur des Longchamps, and Benfey have succeeded in tracing the origin of this collection, its gradual development, and the various changes it has undergone. The original source is the old Indian collection of fables called Panchatantra, which is ascribed to one Vishnus'arman, and which acquired its present form under Buddhist influences, not earlier than the second century B.C. It was afterwards spread over all India, and handed down from age to age in various more or less different versions, and in translations into all the languages of Northern and Southern India. The collection of fables known under the name of Hitopades'a is chiefly based on this older collection. The old Indian Panchatantra was translated into Pehlevi under the title of Kalila and Dimna (the names of two jackals who appear in the first fable), in the sixth century of our era, by Barfuye, physician to King Nushirvan the Great, by whose order the translation was made. This Pehlevi translation was itself the basis of a translation into Arabic, which was made in the eighth century under the Caliph Almansor; and this latter translation is the medium by which these fables have been introduced, directly or indirectly, into the languages of the West. This Arabic Kalila and Dimna was translated (1) into Greek by Symeon Seth about 1080 (Athens, 1851); (2) into Hebrew by the Rabbi Joel about 1250; and (3) into Spanish under Alfonso X. of Castile, also about 1250. The Hebrew version was rendered into Latin between 1263 and 1278 by John of Capua, and the Spanish one was rendered into the same language by Raymond von Béziers about 1313; and one or other of these two Latin versions has been followed in nearly all the translations by which these fables were first introduced into nearly all modern European languages. The first English translation was published in 1570. The original Sanskrit text of the Panchatantra was published by Kosegarten at Rome in 1848–59, and a German translation, by Benfey, with an introduction tracing the stories through their subsequent history, at Leipzig in 1859; there is also a French translation with valuable preface and notes by Edouard Lancereau (Paris, 1871).

PILSEN, NEU, PLZEN, or PILSNA, a town in Bohemia, in a plain between the Mies and Bradawka, which by their confluence a little below form the Beraun, 53 miles south-west of Prague. It is walled, entered by five gates, and is well built and well paved; has a deanery church, a splendid Gothic structure of the thirteenth century; a town-house, Franciscan monastery, theatre, lyceum, gymnasium, barracks, infant and other schools; and important manufactures of woollens, leather, pottery-ware, musical instruments and iron-wire, large breweries, and a considerable general trade. Coal, iron, and alum are worked in the neighbourhood. Pilsen possessed a printing-press as early as 1475. It was once a fortified town, and was several times besieged during the Hussite wars. In 1618 it was stormed by Mansfeld; and at a later period, in the Thirty Years' war, was for a time the head-quarters of Wallenstein. Pop. (1880), 38,883.

PIMENTO, or PIMENTA. See ALLSPICE.

PIMPERNEL (*Anagallis*), a genus of plants belonging to the natural order Primulaceæ, and distinguished by a caducous, wheel-shaped corolla, stamens with bearded filaments, and with anthers fixed behind. The fruit is a pyxis or capsule opening by a cup-shaped lid. The *Anagallis arvensis*, or Field Pimpernel, is a beautiful annual, which grows in cultivated districts, and is common nearly everywhere in Europe,

as well as in many parts of Asia. Its stem is creeping and branching; the corolla exceeds the calyx but little. The flowers are sometimes scarlet, with a purple spot in the centre, and sometimes blue. These two kinds are sometimes regarded as distinct species, called respectively *Anagallis phœnicea* and *Anagallis cærulea*, and sometimes only as varieties. This species is commonly known in England (where the scarlet-flowered variety is by far the most common) as the 'poor man's weather-glass,' from the fact that its flowers do not open in rainy weather. In fine weather they open about eight in the morning and close about noon. The Bog Pimpernel (*Anagallis tenella*) is an extremely delicate and beautiful plant, which grows in the drier parts of marshes in England, but is seldom seen in Scotland. Its flowers are red, and it is distinguished from the Field Pimpernel by the fact that its corolla considerably exceeds the calyx. The blue and lilac varieties of the *Anagallis collina*, originally a native of South Africa, have been introduced into gardens in Great Britain, where they have a fine effect.

PIN, a piece of wire, generally brass, sharp at one end and with a head at the other, chiefly used by women in adjusting their dress. By the old methods of manufacture the distinct processes were usually said to be fourteen, beginning with straightening the wire after it had been thoroughly cleaned and brought to the required size. The straightening was effected by drawing it between iron pins fixed in a board in a zigzag manner. The wire was thus run out into lengths of 30 feet, which were again cut into shorter pieces, each sufficient for three, four, or six pins. Pointing was done by grinding the ends upon stones or steel cylinders, thirty or forty of the wires being held together in the hands and made to rotate as their ends were applied to the grinding surfaces. A lad of twelve years of age could thus point 16,000 in an hour. They were then cut into the right lengths, and the bits not pointed were returned to the pointer. The pin-heads, made of a finer wire, were prepared by winding them by a lathe into a spiral round other wires. Three turns of the spiral being cut off furnished the head for one pin. The heads were annealed by being brought to a red heat, and then shaped by the blow of a hammer. Each one being taken up on a pin-wire, and this introduced point downward in a hole in the centre of a die, a blow from a drop-hammer worked by a treadle secured the head to the pin. Several additional processes were necessary for preparing the pins for market, and though the pins are now made almost entirely by machinery these processes still remain much the same. They are cleaned by boiling them half an hour in sour beer or solution of tartar. To whiten or tin them they are laid in a copper pan, in alternating layers with grain-tin, and when the vessel is nearly full water is added and heat applied; when hot some cream of tartar is added, and the boiling is continued for an hour. To give them a polish they are put into a tub containing a quantity of bran, which is set in motion by turning a shaft that runs through its centre, and thus by means of friction the pins become entirely bright. Sticking the pins in papers was formerly a source of employment to great numbers of women and children about the pin-factories, but this is now done by an ingenious and complicated machine. Solid-headed pins, which are those now generally in use, were first made in 1824 by a machine invented by Mr. Wright of the United States. Various improvements have since been introduced, especially by Mr. Howe, and the machines now used, which complete the pin to the colouring and polishing, are altogether too complicated for a particular description.

PINA CLOTH, an extremely soft and delicate fabric, the manufacture of which is peculiar to Manilla. It is made from the unspun fibres of the leaves of the cultivated pine-apple plant (*Ananassa sativa*), and the finer qualities are always made in small pieces, since only single fibres are used for them. For the coarser qualities several fibres are often joined together, so as to make warp threads of considerable length. Its colour is almost white, but has a slight tinge of yellow in it. In spite of the delicacy of its texture it is remarkably strong. Its chief use is for making ladies' pocket handkerchiefs, but it is sometimes also used for dresses. It is frequently adorned with exquisite embroidery.

PINACOTHEK, or PINAKOTHEK (Greek *pinakothēkē*), a name sometimes applied in Germany to galleries of art, especially collections of paintings. The Pinacothek formed by Louis I. of Bavaria at Munich is particularly famous.

PINCHBECK, an alloy of copper, known also under the names of *imitation bronze*, *tombac*, *Mannheim gold*, *prince's metal*, &c. This alloy contains about 80 per cent. of copper and 20 per cent. of zinc, lead and a little tin being also sometimes present. It is cheaper than true bronze, which is an alloy of copper and tin, and is much used for making ornamental articles.

PINCKNEYA PUBENS, or GEORGIA BARK, a small tree closely resembling the cinchona or Peruvian bark, and said to possess the same febrifuge qualities, growing wild in the southern parts of Georgia. It belongs to the natural order Cinchonaceæ. It rarely exceeds 25 feet in height, by 5 or 6 inches in diameter at base; the leaves are opposite, 5 or 6 inches long, oval, and acute at each extremity; the flowers are pretty large, white, with longitudinal stripes of rose-colour, and are disposed in beautiful clusters at the extremities of the branches; each flower is accompanied with a floral leaf, bordered with rose-colour near the upper margin; the corolla is tubular; the stamens five, with a single style; and the capsule contains two cells and numerous seeds. The wood is soft and unfit for use in the arts. The inner bark is extremely bitter, and is the part employed with success in intermittent fevers.

PINDAR, the most impetuous and sublime of the lyric poets of Greece. Pindar was born in Bœotia, in or near Thebes, of a noble family, in the sixty-fifth Olympiad, about 522 B.C. His father, or his uncle, is said to have been a flute-player, and he is said to have been himself a masterly performer on the lyre. At an early age he was instructed in music and poetry; and for the development of his poetical talent he was sent to Athens, where he became the pupil of Lasus of Hermione, the founder of the Athenian school of dithyrambic poetry. In after-life he showed himself a great admirer of Athens and the Athenians, who rewarded him during his lifetime for the honours he paid to them by making him a public guest of the city and giving him a present of 10,000 drachmas, and after his death erected a statue in his honour. On his return to Thebes he was especially indebted for the further cultivation of his poetic gifts to the beautiful Corinna, who was herself a distinguished poet, and is said to have obtained the prize more than once in the poetic competition with her friend. He was held in great honour by many princes of Greek states, for whom he composed choral songs. Alexander, king of Macedonia, was one of his most ardent patrons, and it was probably in gratitude for the praises Pindar bestowed upon him that his descendant, Alexander the Great, gave orders that Pindar's house in Thebes should be spared when the rest of the city was destroyed. Little else is known with certainty of his life; even the date of his death

is doubtful; according to some he died in his sixty-fifth year, according to others he lived to the age of eighty or ninety. The most probable account appears to be that he died at the age of eighty, in which case his death would fall about 442 B.C. He practised all kinds of lyric poetry, and excelled equally in all. His works embraced hymns to the gods, pæans, dithyrambs, dancing and drinking songs, dirges, panegyrics on princes, and hymns in honour of the victors of the games, but the only poems of his, with one exception, which have come down to us entire belong to the last class, the Epinicia. The one exception referred to is the ode which appears in editions of Pindar as the eleventh Nemean, and which was intended to celebrate the installation of Aristagoras as prytanis at Tenedos. Forty-five of the epinician odes of Pindar are still extant (including the one just mentioned). Fourteen of these are in celebration of Olympic victors, twelve of Pythian, eleven of Nemean, and eight of Isthmian. Not only the conquerors and their fellow-citizens, but all assembled Greece, was celebrated in his poems, and thus they were soon spread wherever the Greek language was spoken. To understand Pindar it is necessary to be intimately acquainted with Greek antiquities. In the judgment of the best critics his poems belong to the most beautiful remains of ancient literature. Fragments of his other works have also been preserved. Of the editions of Pindar the following deserve to be recommended:—that of Böckh (Leipzig, 1811–22, two vols.); that of Dissen (second edition, by Schneidewin and Leutsch, Gotha, 1843–65); that of Bergk, in the Poetæ lyrici Græci (third edition, Leipzig, vol. i., 1866); and that of Mommsen (Berlin, 1864). His odes have been translated into English by F. A. Paley and others.

PINDAR, PETER. See WOLCOT.

PINDAREES (that is, *freebooters*), the name given in British India to the hordes of mounted robbers who for several years (after 1812) infested the possessions of the East India Company. In the autumn, when the Narbada is so low that it is fordable by cavalry, they entered into the rich territory of the Company, devastated the country, and carried off the spoils to their mountains. These freebooters had existed since 1761, but made themselves particularly formidable in the beginning of the following century. They were descended mostly from the caste of Mohammedan warriors, which formerly received high pay from the Indian princes. But the British East India Company disarmed many of the tributary native princes, and maintained under the command of the British residents at the Indian courts large bodies of mercenary troops, which the mediatized nabobs were obliged to pay. The number of the Pindarees was thus increased, and they were secretly excited by the Indian tributaries to attack the Company. In 1817 the British governor-general, the Marquis of Hastings, determined on the destruction of these robbers, whose force was estimated at 40,000 horse. Attacked on all sides, they were conquered and dispersed. Garrisons were placed in some fortresses, and hostages taken to Calcutta; their other strong places were demolished. A flying party of sepoys was kept without intermission on the right bank of the Narbada, &c. At last a moderate yearly tribute was imposed on the subjected tribes.

PINDEMONTE, CAVALIERE IPPOLITO, an Italian poet, was born at Verona in 1753, and at the age of eighteen years distinguished himself by his poetical productions. Having travelled through Italy, France, and Britain, he preserved the impressions made on him by his journey in his Viaggi. In his Poesie Campestri he speaks with enthusiasm of British scenery and life. His Arminio, a tragedy founded on the death of Arminius, contains choruses of warriors and virgins which are models of style. His lyric poems are among his best works, and display a depth of thought and feeling with which the author seems to have been inspired by British literature. Besides translations from Homer, Virgil, Ovid, and Catullus, his Fata Morgana, Elogia di Gessner, and Il Colpo di Martello, are worthy of notice. Pindemonte died in 1828.—His brother, the MARQUIS GIOVANNI PINDEMONTE (born 1751, died 1812), was the author of some dramatic works—Componimenti Teatrali—and translated Ovid's Remedia Amoris.

PINDUS, the ancient name of the principal mountain range of northern Greece, running from north to south about midway between both seas, and forming the boundary between Thessaly and Epeirus. In its northern part it was called Lacmon or Lacmus (now Metzovo), and here the largest rivers of Greece had their origin—such as the Peneius, Achelōus, and Haliacmon. It was, like Helicon and Parnassus, a seat of Apollo and the Muses.

PINE. The natural order Coniferæ, of which the pine is the most important genus, is divided into two sub-orders, namely, 1. *Abietineæ*, the fir tribe; and 2. *Cupressineæ*, the cypress tribe. The general characters of the order are the following:—Trees or shrubs, with disc-bearing woody tissue; linear or lanceolate leaves with parallel veins, sometimes clustered, and having a membranous sheath at the base; flowers unisexual, the male in deciduous catkins, the female in cones; no style nor stigma; ovules naked, one, two, or several at the base of each scale; fruit a cone formed of hardened scales; embryo included within a fleshy, oily albumen. In the *Abietineæ* the ovules are inverted, and the pollen is oval or curved. In the *Cupressineæ* the ovules are erect, the pollen is spheroidal, and the cone occasionally succulent, as in the galbulus of the juniper. The leaves of all the species of pines may be classed according to the number united in a sheath. All the European species, except *P. Cembra*, have only two leaves in a sheath; most of the Asiatic, Mexican, and Californian kinds have three, four, or five leaves, and those of the United States and Canada have generally three. The cones also afford an important ready means of classification.

The Scotch Pine or Fir (*P. sylvestris*) is a tall, straight, hardy tree, from 60 to 100 feet high; a native of most parts of Europe, flowering in May and June, and, as might be expected from its wide geographical range, having many varieties. Its leaves are rigid, in pairs, somewhat waved and twisted, slightly concave on the upper and convex on the under surface; light bluish green, finely serrulated on the edges; the cones from 2 to 3 inches in length, and 1 inch to 1¼ in breadth; scales from 1 inch to 1¼ long, terminating in an irregular four-sided point, often recurved. The bark is of a reddish tinge, comparatively smooth, in some varieties scaling off, and in others rough and furrowed. The branches are disposed in whorls, from two to four or five or six together, at first slightly turned up, afterwards taking a horizontal direction, and finally becoming somewhat pendant, except those branches forming the summit of the tree. The leaves are distinguishable from those of all other pines in which they occur in pairs by their glaucous hue, especially when young. The Scotch Pine always occurs in masses; it is considered full grown and fit to be cut down for timber in fifty or sixty years; but in the north of Scotland, where pine forests grew to perfection in former times, the tree continued to increase in bulk for three or four centuries. The quality of the timber varies with soil and climate, but the best wood is said to be produced in cold situations. Its durability, according to

Brindley the engineer, is equal to that of the oak. The tree is most abundant in the north of Europe, between latitude 52° and 65°. There are extensive forests of it in Russia, Poland, Sweden, Norway, Germany, the Alps, the Pyrenees, and the Vosges. In Scotland it grows at the height of 2700 feet on the Grampians; it is found at the height of 2300 feet on Ben-na-Buird, in Aberdeenshire; and at an equal height on the mountains near Loch-na-Gar. In all these situations it is found on soils dry, sandy, gravelly, granitic, or argillaceous, and least frequently on a calcareous soil. The magnificent pine forests of the Northern and Western Highlands of Scotland were resorted to for timber a century ago, when the cost of wood began to increase; and in the woods of Sir Thomas D. Lauder the forests were 'unmercifully slaughtered,' in consequence of the enhanced price of Baltic timber during the wars of the latter part of last and the beginning of the present century. In 1786 the Duke of Gordon sold his Glenmore Forest to an English company for £10,000. It was supposed to be the finest pine wood in Scotland. Many of the trees felled measured 18 feet and 20 feet in girth; and there is still preserved at Gordon Castle a plank nearly 6 feet in breadth, which was presented to the duke by the company.

The Labrador or Banks's Pine (*P. Banksiana*) is a low straggling tree in its native country, growing among barren rocks to a height of from 5 to 8 feet, but in British collections, in good soil, attaining three times that height. The cones are recurved and twisted; and the leaves are regularly distributed over the branches, instead of being collected in tufts alternating with naked spaces, as in most other pines, a distinction, therefore, by which this species is easily recognized. In Nova Scotia and the State of Maine it is known as the Scrub Pine, and in Canada as the Gray Pine. It is not common in English nurseries, although the plant appears to have been introduced into Britain nearly a century ago. Loudon remarks that as an ornamental tree it is 'one of the most interesting of the genus, from the graceful manner in which it throws about its long, flexible, twisted branches, which are generally covered throughout their whole length with twisted glaucous green leaves, with here and there a whorl of curiously hooked horn-like cones.' It is one of the hardiest of the Abietineæ.

The Corsican Pine (*P. Laricio*) grows to a height of from 80 to 100 feet, and in the island of Corsica it is said to reach an altitude of 140 to 150 feet. The trunk and branches have a reddish-coloured bark, like that of the Scotch Pine. The leaves vary from 4 to 7 or 8 inches in length, and are dark coloured. The cones occur in clusters of two or more, pointing slightly downwards, are 2 or 3 inches long, and of a ruddy yellow or tawny colour.

The Pinaster, or Cluster Pine (*P. pinaster*), is indigenous to the south of Europe, to the west of Asia, the Himalayas, and, it seems, even to China. It is a large, handsome, pyramidal tree, varying from 40 to 60 feet in height, and readily distinguished from other pines by its clustering masses of foliage, of a lighter green than the Corsican pine. Its cones point upwards, in star-like clusters, whence the name of Pinaster or Star Pine. It is of rapid growth, plants having in twenty years from the seed reached a height of 30 feet in the climate of London. In France it covers immense tracts of barren sand, in which it has been planted to prevent the sand from drifting. It yields resin and tar to the inhabitants of the Landes of Bordeaux, and between that city and Bayonne, where the pinaster forests are named *pignadas*.

The Stone Pine (*P. pinea*) is a lofty tree in the south of Europe, where it is a native; its spreading head forms a kind of parasol; the trunk is 50 or 60 feet high, and clear of branches; the bark is reddish, and smooth; the leaves are of a deep green, semicylindrical, 6 or 7 inches long, two in a sheath, and forming a triple spiral round the branches. The fruit ripens at the end of the third year, when the cones are about 4 inches long and 3 inches in diameter, having a reddish hue. Each scale is hollow at its base, and in its interior are two cavities, each containing a seed much larger than that of any other species of European pine. The ligneous shell enveloping the kernel is hard, but in the variety *P. p. fragilis* is tender and easily broken by the fingers. In both kinds the kernel is white, sweet, and agreeable to the taste. In Britain the Stone Pine seldom exceeds the size of a large bush, although specimens have reached a height of 30 and 40 feet. The kernels have been found among the domestic stores of Herculaneum and Pompeii. The tree has been known in England for three centuries.

Sabine's Pine (*P. Sabiniana*) was discovered in California by David Douglas in 1826, and named after his early friend and patron Mr. Sabine. The leaves are in threes, rarely in fours, from 11 to 14 inches long; the trees are of a tapering form, straight, and from 40 to 120 feet high, with trunks from 3 to 12 feet in diameter. The cones measure from 6 to 8 inches round. This species is said to be as hardy in this country as the pinaster.

Coulter's Pine is variously described as a separate species and as a variety of Sabine's. It was found by Dr. Coulter growing on the mountains of Santa Lucia in lat. 36°, and at an elevation of 3000 to 4000 feet. The leaves are broader than those of any other pine, and the cones, which grow singly, are the largest of all, being often more than 1 foot long and 6 inches in diameter, and weighing about 4 lbs. In its general appearance the tree resembles Sabine's Pine, but is distinguished from it by the upright character of its foliage. Both species are hardy, and of surpassing beauty.

The Cembran Pine (*P. Cembra*) has its leaves in fives, three-ribbed; cones about 3 inches long; seed larger than that of any other species except the Stone Pine. The tree is a native of Switzerland and Siberia. In Britain it is an erect tree, with smooth trunk and whorls of branches. Lambert states that the flowers have a more beautiful appearance than those of any other species of pine. Although usually of slow growth, yet plants sown in the neighbourhood of Edinburgh were found to have attained a height of from 8 to 12 feet in eight years. The wood is soft and its grain extremely fine.

The Red Canadian Pine (*P. resinosa*), inhabits the whole of Canada from the Atlantic to the Pacific, and is also found in the northern and eastern parts of the United States. In Canada and Nova Scotia it is called Yellow Pine—it is sometimes also improperly termed Norway Pine. Even in those districts where most common it only occupies small tracts of a few hundred acres, where the soil is dry and sandy, and grows either alone or in company with the white pine. The trunk rises to the height of 70 or 80 feet by about 2 in diameter at the base, and is chiefly remarkable for its uniform size for two-thirds of its length: the bark is clear, red, and smooth; the leaves are in pairs, and are collected in bunches at the extremity of the branches; and the scales of the cones are unarmed. The wood is compact, fine-grained, resinous, and durable. In the British provinces and in Maine it is frequently employed in naval architecture, especially for the decks of vessels, furnishing planks free from knots, of 40 feet in length. It is also used for masts, and has furnished the mainmast

of a 50-gun ship. It is exported to Britain both from Maine and from the St. Lawrence.

The true Yellow Pine (*P. variabilis*) rises to the height of 50 or 60 feet, by 15 or 18 inches in diameter at base, and sometimes more; the leaves are 4 or 5 inches long, and are usually in pairs, but sometimes in threes on the younger shoots; the cones are small, oval, and armed with fine spines. The timber is fine grained, compact, and moderately resinous. Immense quantities are used in naval architecture at New York, Philadelphia, and Baltimore, for decks, masts, yards, beams, and cabins.

The Jersey Pine (*P. inops*) has received this appellation from being most abundant in the lower part of New Jersey, where it grows in company with the yellow pine. This is a small straggling tree, rarely attaining the height of 30 or 40 feet, with a diameter of a foot at base. The leaves are in pairs, 1 or 2 inches long, and the cones 2 to 3 inches long, and armed with strong spines. The trunk is too small to be of any utility in the arts, and besides consists of a great proportion of sap.

The Pitch Pine (*P. rigida*) is most abundant along the Atlantic coast, where the soil is diversified, but generally meagre. The ridges of the Alleghanies in Pennsylvania and Virginia are sometimes covered with it. The 45th degree of latitude appears to be its northern limit. It is frequently seen in large and miry swamps, and in such situations attains the height of 70 or 80 feet by 2 in diameter at base; and it appears to support the presence of sea-water better than any other pine. The leaves are in threes, varying much in length, as do the cones in size; the latter are armed with acute spines. The branches are numerous, and occupy two-thirds of the trunk. The quality of the wood varies according to the situation; in swamps it is light, soft, and consists of a greater proportion of sap; but in a dry, gravelly soil it is compact, heavy, and contains a large proportion of resin.

The Loblolly Pine (*P. tæda*) often exceeds 80 feet in height, with a wide-spreading summit, and, next to the white pine, is the loftiest American species. The leaves are 6 inches long, united by threes, or sometimes fours on the young and vigorous shoots. The cones are 4 inches long, and armed with strong spines. The timber decays speedily on being exposed to the air; this is to be regarded as one of the least valuable of the pines.

The Long-leaved Pine (*P. palustris*) abounds in the lower part of the Carolinas, Georgia, and the Floridas. Not only does it furnish resin, tar, pitch, and turpentine, but the timber is hardly inferior to the white oak in naval architecture, and, moreover, the tree grows only in a soil so sterile as to be incapable of being converted to any other use. It is known in commerce under a variety of names; in those districts where it grows it is called long-leaved pine, yellow pine, pitch pine, and broom pine; in Britain, Georgia pitch pine. It grows to the height of 60 or 70 feet, with a trunk 15 or 18 inches in diameter for two-thirds of this height. The cones are 7 or 8 inches long by 4 in diameter, are armed with small spines, and contain seeds of an agreeable flavour. The unusual length of the leaves, about 12 inches, gives this tree a peculiarly striking appearance. The trunk contains but little sap, and the concentrical circles are close and at equal distances, while the resinous matter is abundant and equally distributed, which renders the wood stronger, more compact, and more durable than in the other species; it is, besides, fine-grained and susceptible of a brilliant polish, and is applied to a great variety of uses. That variety which acquires a reddish hue from growing in certain soils, and is known by the name of red pine is most esteemed, and in the opinion of some shipwrights is as solid and durable on the sides of vessels as the white oak of the country.

The Weymouth Pine (*P. strobus*) is a lofty tree, and its timber, though not without essential defects, is consumed in much greater quantities, and for a far greater variety of purposes, than almost any other. It attains the height of 150 feet, and even 180, with a trunk 5 feet and upwards in diameter; the leaves are in fives, and the cones are 4 or 5 inches long, pendulous, with thin, smooth scales. Owing to the lightness and delicacy of the foliage the young trees make an elegant appearance. The wood has little strength, and is liable to swell from humidity in the atmosphere; but it is soft, light, free from knots, easily wrought, durable, furnishes boards of great width, and, above all, is still abundant and cheap. It is employed for masts, and great numbers of these masts are exported to Britain, and are said to be lighter than the Riga masts, but have less strength: the bowsprits and yards of men-of-war are also made of this pine.

Lambert's Pine (*P. Lambertiana*) is of gigantic size, growing between the fortieth and forty-third parallels of latitude, and about 100 miles from the Pacific. The trunk rises from 150 to upwards of 200 feet, and is from 7 to nearly 20 feet in diameter. It is straight, and destitute of branches for two-thirds of its height. The leaves are in fives, and the cones are pendulous at the extremities of the branches, and require two years to attain their full growth, when they are 14 to 16, and sometimes 18 inches, and nearly 4 inches in diameter at the thickest part. The timber is white, soft, and light, and produces abundance of a pure amber-coloured resin, which, when the trees are partly burned, acquires a sweet taste, and in this state is used by the natives as a substitute for sugar. The seeds are eaten either roasted or pounded into coarse cakes for use during the winter season.

PINE-APPLE (*Ananassa sativa*), a plant belonging to the natural order Bromeliaceæ, much esteemed for its fruit. It was originally found by the Europeans in Peru, and has not been known in Europe above two centuries. It passed from Brazil to the West Indies, and thence was transported to the East Indies, where it has long been successfully cultivated. The leaves are canaliculate, and spiny on the margin; the stem erect and about 2 feet high; the flowers blue and united in a dense spike, which is crowned at the summit with a tuft of leaves; the fruit is formed by the union of numerous succulent ovaries and bracts. The seeds have been rendered abortive by cultivation. The pine-apple is most readily reproduced by planting the terminal tuft of leaves; but in our greenhouses it is far inferior to the tropical fruit, and yet is generally cultivated in many parts of Europe, especially near the larger cities. Many varieties of the pine-apple have been produced, but they may be referred to seven principal ones. Some of the other species of Bromeliaceæ have crowns, and the fruit of most of them, though small, is eatable. The *Bromelia pinguin* has the fruit separately in clusters, and not in a cone, and the leaves afford a fibre which is manufactured into cordage, or sometimes into good cloth. A beautiful fibre is also yielded by the common pine-apple plant, which is employed for textile fabrics. (See PINA CLOTH.) From the pine-apple is made very good wine, which turns in about three weeks, but recovers by longer keeping. The fruit is also sometimes preserved entire, and when taken out of the syrup is iced with sugar.

PINE FINCH, or PINE GROSBEAK (*Pinicola*, or *Pyrrhula enucleator*), a genus of Conirostral Perching Birds or Insessores, belonging to the sub-family of the Bullfinches (*Pyrrhulinæ*). It is of larger size

than the Common Bullfinch, and measures from 8 to 9 inches in length. The head, fore-parts, neck, and rump are coloured bright red. The back is a blackish brown, the feathers of this region having red edges, the lower portion of the body being of a light gray hue. The wings and tail are dusky, the wing-feathers being variously marked with white strips and patches. The food consists of the delicate buds and leaves of plants and trees, the buds of the birch-willow being said to form its chief article of diet in its native haunts. As implied by its popular name this finch chiefly inhabits pine forests. It occurs in the Arctic and northern regions of both Old and New Worlds. It breeds in these northern portions, but in America appears to migrate southwards to the United States. It is more rarely found in the temperate portions of Europe. Its song notes are agreeable, and its flesh is esteemed in Russia, in which country it forms a marketable delicacy. Four or five eggs of a pale green colour spotted with brown are produced; the nest, roughly built of sticks and lined with feathers, being placed on a branch of a tree near the ground. Audubon says that these birds are exceedingly tame and tolerant of the human presence even in a wild state.

PINEL, PHILIPPE, member of the French Institute and of the Legion of Honour, the Howard of the insane, was born in 1745, at St. André, in the department of Tarn, studied at Toulouse and Montpellier, where he supported himself by teaching mathematics. In 1778 he went to Paris, and at first applied himself to the study of the sciences connected with medicine, but afterwards devoted himself entirely to that science itself. In 1791 he was made directing physician at the Bicêtre, an insane hospital, and in 1794 at the Salpêtrière. The harsh treatment of the insane then in vogue, their chains and unhealthy dungeons, filled him with horror. He introduced gentle treatment, uniting firmness with kindness, and was the first definitely to recommend moral remedies (in his work Sur l'Aliénation mentale), and one of the earliest to establish a regular system in the mad-houses. He also proved the existence of what he called *manie sans délire*. He placed less stress on physical treatment, and in particular he agreed with Bordeu in condemning blood-letting. In general he recommended delay. 'What art cannot effect,' he used to say, 'time may accomplish.' His pathology was founded on Condillac's system of philosophy, and was directed more to a consideration of the obvious phenomena than to a thorough insight into the nature of diseases; yet his Nosographie philosophique (Paris, 1798; sixth edition, 1818) formed an epoch in French medicine, as it supplied a want then generally felt. In many respects Pinel is to be considered as the precursor of Bichat, since he was the first to point out the physiological and pathological difference of the various tissues. He edited for some time the Gazette de Santé, and was a collaborator in Fourcroy's Médicine éclairée par les Sciences physiques, and in the great Dictionnaire des Sciences médicales. During the reign of terror Pinel concealed the unfortunate Condorcet in his house. In 1823, when the school of medicine was reformed by the government, M. Pinel was removed from his post on suspicion of entertaining liberal principles; and he died three years later, at the age of eighty-one years.

PINE-RESIN. The juice which exudes from pines, firs, and other coniferous trees contains a mixture of resins generally containing oxygen with volatile oils, and sometimes acid bodies. The resin *colophony* ($C_{20}H_{30}O_2$) is characteristic of these juices.

PINEROLO, a town, Kingdom of Italy, in the province of Turin, 21 miles south-west of the city of that name, at the mouth of Val Clusone. It has several squares, one of them, the esplanade, forming a finely planted walk. The cathedral, a modern structure, possesses little merit; but one of the churches is of ancient Gothic; and there are several monasteries and nunneries, a town-house, episcopal seminary, college, and handsome barracks. The citadel of Pinerolo was the prison of the Man with the Iron Mask, Fouquet, and Lauzun. The manufactures are woollen and silk goods, iron-ware, firearms, vermicelli, liqueurs, and spirits. Pop. 11,832.

PINE WOOL, the name given to the fine fibres of the leaves of the pine-tree, when separated and dressed into a state in which they much resemble cotton. The preparation of this material is chiefly carried on near Breslau in Silesia, by the inventor Pannewitz. It is used for making wadding, stuffing cushions, mattresses, &c.

PINEY VARNISH, a name of gum anime or East India copal. See COPAL.

PINION, in mechanics, an arbour or spindle in the body of which are several notches, which catch the teeth of a wheel that serves to turn it round; or it is a lesser wheel that plays in the teeth of a larger one.

PINK (*Dianthus*), a genus of plants belonging to the natural order Caryophyllaceæ. More than 100 species are known, all, with perhaps one or two exceptions, natives of the northern and temperate parts of the European continent. Their roots are annual or perennial; the stems herbaceous and jointed; the leaves opposite and entire, and the flowers terminal, aggregate, or solitary, and always beautiful. Many are common in gardens; and perhaps no plant is more highly esteemed by the florist than the carnation, both for its beauty and its rich spicy odour. Nearly 400 varieties are enumerated.

PINKERTON, JOHN, F.S.A., an eminent antiquary, was born at Edinburgh in 1758, and was articled to a writer to the signet, in whose office he continued five years. In 1780 he went to London to devote himself solely to literature, where in 1781 he published an octavo volume of miscellaneous poetry, under the title of Rimes, with dissertations On the Oral Tradition of Poetry, and On the Tragic Ballad, &c. In 1783 he published his Select Scottish Ballads in two volumes. Among the pieces in these volumes were a number by Pinkerton himself, though at that time he represented them as genuine ancient productions. His Essay on Medals (1784, two vols. 8vo) went through three editions. In 1785 he published Letters on Literature, under the assumed name of Heron. In this publication he ventured upon a novel system of orthography, substituting *a* for *s* to indicate the plural. The work obtained him the acquaintance of Horace Walpole, after whose decease he published Walpoliana. Next year appeared Ancient Scottish Poems, from the Manuscript Collection of Sir Richard Maitland of Lethington, with Notes and a Glossary. These poems were by many believed to be forgeries by Pinkerton himself, but it is now well known that this was not the case. The Maitland MS. is contained in the Pepysian Collection at Cambridge. A Dissertation on the Origin and Progress of the Scythians or Goths appeared in 1787; in this work the author first obtruded that strong prejudice against the Highlanders which raised a host of enemies. In 1790 he published his Inquiry into the History of Scotland preceding the Reign of Malcolm II. or 1056. This work, notwithstanding that the author's absurd animosity to the Celtic race necessarily hindered him from being an impartial judge, is yet a most valuable one, and contains some rare and curious documents. It may be said to have been the first work which thoroughly

sifted the great 'Pictish question,' the question whether the Picts were Goths or Celts. Pinkerton scouted the idea of their belonging to any other race than the Gothic. He characterizes the Celts as 'mere savages but one degree above brutes;' and remarks 'all we can do is to plant colonies among them, and by this and encouraging their emigration try to get rid of the breed.' His chief remaining works are the Medallic History of England (4to); Scottish Poems, reprinted from scarce editions (three vols. 8vo); Iconographia Scotica, with Notes (two vols. 8vo); Modern Geography, digested on a New Plan (two vols. 4to, 1802; reprinted three vols. 1807); General Collection of Voyages and Travels (nineteen vols. 4to); &c. He died at Paris, March 10, 1826.

PINNA, or WING SHELL, a genus of Lamellibranchiate Mollusca included in the family Aviculidæ. The Pinnæ possess wedge-shaped shells of a horny, delicate structure. The hinge is toothless. The umbones or beaks of the shell form a pointed extremity. The edges of the mantle are doubly fringed. The foot is long and grooved, and secretes a 'beard' of 'byssus' in great quantity and of strong, silky texture. The genus is represented by the *Pinna pectinata* of the British coasts, by the *P. nobilis* of the Mediterranean Sea, by the *P. bullata*, *P. rudis*, *P. nigrina*, and by other species. The 'byssus,' like that of the mussel, is used to moor or attach the animal to rocks and fixed objects, and the *P. nobilis* in past days afforded sufficient material from its byssus for the Neapolitans, Sicilians, and Maltese to weave quantities of a durable silk fabric which was used in the manufacture of stockings and similar articles. By the ancients this byssus material was also used and highly valued, and frequent mention is made of the fabric by Latin authors. Pope Benedict XV. in 1754 had a pair of stockings presented to him which were made from the byssus of the Pinnæ. (Pl. CXXX.-CXXXI. fig. 17.)

PINNACE, a small vessel used at sea, with a square stern, having sails and oars, and carrying three masts, chiefly employed to obtain intelligence and to land men, &c. One of the boats of a man-of-war, used to carry the officers to and from the shore, is also called the pinnace. It is smaller than the launch, but larger than the cutter, and is rowed by from ten to sixteen oars.

PINNACLE, in architecture, a small square or polygonal shaft, terminating upwards in the form of a pyramid, embellished with foliage at the angles of the pyramidal part. It is much employed in Gothic architecture as a termination to buttresses, the tops of gables, &c., in which cases it is in the form of a spire with crockets and a finial. The decorated pinnacles have often in their faces niches occupied with statues, and are highly ornamented.

PINNIGRADA. See CARNIVORA.

PINNIPEDIA. See CARNIVORA.

PINSK, a town of Western Russia, in the government of Minsk, and 148 miles S.S.W. of the city of that name, on the left bank of the Pripet, which here receives the Pina. It stands among marshes, and is very indifferently built. It has considerable manufactures of Russian leather, and an active transit trade is carried on by means of the Oghinsky Canal, which connects the Dnieper and the Black Sea with the Niemen and the Baltic. The trade consists chiefly in corn, salt, hemp-seed, tar, tallow, iron, glass, tobacco, and timber, and is carried on mainly by Jews, who form about three-fourths of the population. In 1648 a great battle was fought here between the Cossacks and the Poles, during which 5000 houses were burned down, and 14,000 persons were killed. The town, which has never recovered its former prosperity, fell into the possession of Russia at the second partition of Poland in 1793. Pop. 17,718.

PINT, a measure of capacity used for both liquids and dry goods; it is the eighth part of a gallon, or 34·65925 cubic inches. The Scotch pint, equivalent to 3·0065 imperial pints, though no longer a legal measure, is still in use.

PINTAIL DUCK, a genus of Anatidæ or Ducks, so named from the elongated form of the tail-feathers. These ducks form the genus *Dafila*, the Common Pintail Duck being the *Dafila acuta* of the naturalist. The hinder toe, as in the true Ducks, is small and not attached to the other digits by the web or membrane which unites the front toes. The bill is destitute of a basal tubercle. The lamellæ, or plate-like fringes of the bill, are narrow, and do not project. The tail in the males is long, and exhibits a pointed tapering conformation. In size the Pintails equal the Mallards, and are thus larger than the common ducks, the neck being elongated in proportion. The head in the Common Pintail Duck is coloured brown, a white streak extending from the head down the neck on each side. The general body colour is a grayish-white; the lower parts being white, and the central tail-feathers black. The Pintails chiefly inhabit the southern regions of the world, and are found principally in the vicinity of fresh-water lakes. These birds are found on the British coasts in summer, but migrate southwards in winter. They are common in the Mississippi Valley, and they occur on the Mediterranean coasts, in the Gulf of Mexico, in the West Indian Islands, and in Africa. The flight is rapid and noiseless. These ducks breed in confinement, and the flesh is savoury.

PINTURICCHIO, an eminent painter of the Roman school, whose real name was BERNARDINO BETTI, the disciple of Pietro Perugino, was born at Perugia in 1454. He painted chiefly in history and grotesque, but he also excelled in portraits. His chief work was the History of Pope Pius II., in ten compartments, in the library at Siena. Others consider his work in the cathedral of Spello his best performance. His style was effective, but he made use of too splendid colours, and introduced abundance of gilding. He is said to have died of chagrin at the following circumstance: Being engaged to paint a Nativity for the monastery of St. Francis at Siena, he pertinaciously insisted that everything should be removed out of the room in which he worked, and obliged the monks to remove a great chest become rotten from age. In the attempt it burst, and discovered a hoard of 500 pieces of gold, to the great joy of the fathers and the mortification of Pinturicchio. According to a more reliable account, he died of poison administered by his wife, on whose extravagant habits he attempted to put a check. His death took place in 1513.

PIOMBINO, a former principality of Tuscany, lying between Siena and the Mediterranean, opposite the Island of Elba, from which it is separated by the channel of Piombino. Its extent was about 216 square miles, with a population of 25,000 at the time of its incorporation with the Kingdom of Italy (1860). It was originally a fief in the possession of the Appiani family, which, after a rule extending over 300 years, sold it to the Buoncampagni family in 1634. In 1804 Napoleon granted it to his sister Eliza, princess Baciocchi; but by the Congress of Vienna she was rejected, and the old family restored. It now forms part of the province of Pisa.

PIOMBO, SEBASTIANO LUCIANO DEL, a celebrated painter, born at Venice in 1485. His family name was *Luciani*. Having renounced music, of which he was very fond, for painting, he studied at first under Giovanni Bellini, and afterwards under Giorgione,

whose fine colouring he imitated. Sebastiano commenced as a portrait-painter, and the reputation which he soon gained in that branch induced Agostino Chigi, a rich merchant of Siena, to take him to Rome and employ him in ornamenting his house. The delicacy of his pencil was much admired, and Michael Angelo, who seems to have been somewhat jealous of the growing fame of Raphael, encouraged him to enter into competition with that master, and even supplied him with designs, which Piombo often executed very happily, although by no means capable of lofty conceptions or sublime inventions. When Raphael had painted his celebrated Ascension, Sebastiano was induced by Michael Angelo to attempt to surpass it by the Raising of Lazarus, which is considered his greatest work. His Martyrdom of St. Agatha was also ranked among the pieces of the first masters. His chief merit, however, lay in single figures and portraits. His Pietro Aretino and his Clement VII. were admirable likenesses and specimens of perfect colouring. He was high in favour with Clement, who created him keeper of the Papal seals. From this circumstance he derived his surname *Del Piombo*, the seals attached to the Papal bulls being at that time of lead (*piombo*). This post made it necessary for him to assume the clerical habit, and from that time he painted but little. He wrote verses, entertained learned men at his table, and only occasionally painted a portrait. He died in 1547. It also deserves to be mentioned that he invented a peculiar method of painting in oil on walls, in which manner there is a Scourging of Christ to be seen in S. Pietro in Montorio.

PIONEERS, labourers attached to an army for the making and repairing of roads, and performing all labours connected therewith, digging trenches, and preserving cleanliness in the camp when stationary, &c. Originally these duties had to be performed by labourers in the country occupied by the army, but now such persons are only employed as auxiliaries, a number of men being attached to each corps as a permanent body of pioneers. In several armies they are united with the sappers and pontoniers.

PIOZZI, Hester Lynch Salusbury, an English authoress, born in 1739, was the daughter of John Salusbury of Carnarvonshire. Early in life she was distinguished in the fashionable world by her beauty and accomplishments. In 1763 she was married to Henry Thrale, a brewer of great opulence in Southwark, which borough he then represented in Parliament. Soon after commenced her acquaintance with Dr. Johnson, of whom she published Anecdotes in one octavo volume (1786). Mr. Thrale dying in 1781, his widow, who was the mother of four daughters, married in 1784 Piozzi, a Florentine music-master, then resident in Bath. This alliance was keenly resented by all her friends, and Johnson entirely gave up her society. She accompanied her husband to his native city, and while there contributed several poems, signed Anna Mathilda, to the Florentine Miscellany, founded by the leaders of Della Cruscan school. Among her writings are—Observations made in France, Italy, and Germany (1789); British Synonymy, or an Attempt at regulating the Choice of Words in Familiar Conversation (1774); Review of the most Striking Events and Characters of the last 1800 Years (1801), &c. Mrs. Piozzi died at Clifton, May 2, 1821, in her eighty-second year.

PIP, or Pep (*pepia*), a disease among poultry, consisting of a white thin skin or film that grows under the tip of the tongue, and hinders their feeding. It most frequently occurs in damp or very cold weather. Its earliest symptoms are a slight hoarseness and catching in the breath, followed by an offensive discharge from the eyes and nostrils, rattling in the throat, and finally the accumulation of mucus in the mouth. The disease rapidly spreads over a whole poultry-yard, probably owing to the contamination of the water in a common drinking vessel. The diseased birds must be kept warm; some authorities recommend the administration of castor-oil and also a mixture of ½ drachm of dried sulphate of iron and 1 drachm of capsicum, made up into thirty pills with extract of liquorice; one pill to be given three times a day. After a certain time this is substituted by a compound of sulphate of iron, cayenne pepper, and butter. Others recommend that the fowls should be fed on oatmeal mixed with ale, along with a liberal supply of green food. As the birds recover the scale on the tongue will disappear of itself; artificial removal is unnecessary. The eyes, nostrils, and mouth may be washed with vinegar.

PIPA, a genus of Amphibians, popularly designated 'Surinam Toads,' and forming the type of a distinct family (Pipidæ) of the Amphibian order Anoura. The best known species is the *Pipa Americana* of Surinam and Brazil. The tongue is absent throughout this family, and teeth are but rarely developed. In the genus Pipa teeth are totally wanting, but in an allied genus (*Dactylethra*) the upper jaw is provided with minute teeth. The head in the Pipas is of triangular form, the eyes being placed close to the mouth. The body is broad, the hind legs long and powerful, the toes of these legs being fully webbed. The tympanum of the ear is concealed. *Dactylethra* found at the Cape of Good Hope and in Mozambique differs from all other Amphibia (except one of the Salamanders) in possessing nails on the three inner toes of the hind limbs. The Surinam Toad, which is shown on Pl. XV.-XVI. fig. 9, is one of the most repulsive looking of the Toads, and it is noted as exemplifying, in the case of the female animals, an anomalous mode of developing the eggs and young. A number of pits or depressions termed 'dorsal cells' appear to be formed on the back of the female Pipas at the breeding season. In each cell an egg is deposited, the eggs being first deposited by the female in water after the usual method, and being impregnated by the male, who then collects the eggs and places them in the female's back. Each cell appears to be closed by a lid-like fold, and within the cells the development and metamorphosis of the young take place, these new forms emerging from the parental cells in the adult and mature form. It was formerly imagined that the eggs were not only contained as described but also developed within the dorsal cells of the females; but a closer study of the phenomena showed that the eggs were produced and extruded from the reproductive organs as in other Amphibia, and were placed in the cells by the males as already stated. About eighty-two days is stated as the period required for the full metamorphosis and development of the young within the maternal cells.

Notwithstanding the repulsive appearance of the Pipas they are said to be eaten and regarded as delicacies by the natives of Guiana and Surinam.

PIPE, a wine measure, usually containing very nearly 105 imperial or 126 wine gallons. Two pipes or 210 imperial gallons make a tun. In practice, however, the size of the pipe varies according to the kind of wine it contains. Thus a pipe of port contains 138 wine-gallons; of sherry, 130; of Madeira, 110, &c. The pipe of port is seldom accurately 138 gallons, and it is customary to charge what the vessel actually contains.

PIPE, a tube for the conveyance of water, steam, gas, or other fluid, used for a great variety of purposes in the arts and in domestic economy. The

materials of which pipes are made are also very various, wood, stone, earthenware, iron, lead, copper, leather, gutta-percha, &c., being all employed. For many years London was supplied with water by pipes made of elm logs bored through the centre by auger, and fitted together by means of the conical termination at one end entering into the corresponding enlarged cavity of the next length. Pipes of this kind are still used to some extent in countries where wood is plentiful, but they are very defective from the rapid decay they undergo when laid down; and iron or earthenware pipes are being gradually substituted. Drainage and sewerage pipes of great strength and size (measuring from 1 or 2 up to 54 inches in diameter) are now usually made of fire-clay, glazed on their outer and inner surfaces. There is a socket at one end to receive the end of the next. Earthenware pipes are made by squeezing a continuous length of plastic clay through a circular orifice, the centre of which is occupied by a mandril of the size of the interior of the pipe. Large iron pipes are usually cast, and are used for the supply of water and gas in the important towns of Great Britain and many foreign states. A great proportion of the manufacfacture of cast-iron pipes is carried on in Scotland. Small pipes of wrought-iron, brass, or copper, are made by rolling out narrow strips of metal, and then passing them through pairs of rollers, the one of which has a series of projecting beads round it, the other being furnished with corresponding grooves. By this means the edges of the metal strip are turned up. A mandril is then laid in it, and it is passed through a pair of concave rollers, which bring the edges together, thus forming a complete tube. The edges then require soldering. An improved method of producing small metal tubes has now, however, come into general use, and been brought to great perfection. A long cylinder of brass, copper, or tin is cast with a hole down the centre, of the same diameter as the desired bore of the pipe. The cylinder is conical at one end like a pencil. An accurately-fitting mandril is inserted in the hole, and made to project a little at the conical end; it is then brought to the drawing bench, where the tapered end is placed in a funnel-shaped hole drilled in a steel post. The point of the cylinder with the projecting mandril passes through this hole just sufficiently far to be griped by a pair of pincers attached to a strong chain. Machine-power is then applied to the chain, and the metal and mandril are drawn through the hole. By this means the metal is extended equally over the surface of the mandril, which is then withdrawn, and the tube is complete, or it may require to be drawn through several holes gradually decreasing in size. A patent has been recently granted for the manufacture of steel pipes on a similar principle. Lead pipes of almost any length and diameter can be made by a similar process to that adopted for earthenware tubes. The soft metal is pressed through a hole in a steel plate in which there is a fixed mandril, which forms the bore of the pipe.

PIPE, Tobacco, a bowl and connecting tube, made of baked clay, wood, stone, or other material, and used in smoking tobacco. The cheap pipes in common use throughout Great Britain are made of a fine-grained white plastic clay, found chiefly in the Isle of Purbeck in Dorsetshire, and at Newton Abbot in Devonshire. This clay is worked with water into a thin paste, which is allowed to settle in pits, or it may be passed through a sieve to remove all stony impurities. The water is afterwards evaporated till the clay becomes a doughy-like mass, when it is well kneaded to give it uniform consistence. A child takes a small piece of this clay, rolls it with the palms of his hands upon a plank into a slender cylinder, which forms the stem of the pipe. To the end of this cylinder he fixes a lump of clay large enough to form the head or bowl. These rudimentary pipes are arranged by dozens on a board, and set aside for a day or two to gain more consistence. They are then handed to the pipe-maker, who pushes an oiled iron wire along the centre of the stem, so as to form the bore. The bowl is shaped by a folding brass mould channelled inside, each piece being hollowed out like a half pipe cut as it were lengthwise. The pipe is laid in one of the jaws of the mould with the wire still sticking in it; the other jaw is then brought down upon it, and held with a clamp. A lever presses an oiled stopper into the bowl of the pipe while still in the mould sufficiently far to form the cavity, the wire being kept working backwards and forwards along the whole length of the tube to keep it open. The wire is then withdrawn, the mould opened, and the pipe taken out, and the redundant clay is removed with a knife. After drying for a day or two the pipes are scraped, polished with a piece of hard wood, and the stems being bent into the desired form, they are removed to the baking kiln or seggar. This consists of an inner circular chamber with a number of small stages, on which the pipes are arranged with their bowls resting against the circumference, their stems being supported on circular pieces of clay set up in the centre of the chamber for that purpose. The seggar is inclosed within a furnace of ordinary brick-work lined with fire-bricks. Between this and the cylinder there is left a space of about 4 inches all round for the passage of the flame. The inner chamber can be closed so as to exclude all smoke, and with a moderate fire and skilful packing, as many as 50 gross of pipes may be baked in eight or nine hours. When thoroughly baked they receive another polishing, and are then ready for the market. A clay pipe should not be too hard baked, should have a moderately long and slightly bent stem, an almost conical-shaped bowl, not rising from the stem at an acute angle; both stem and bowl should also be of moderate thickness. A pipe made on this principle will allow free passage to the smoke, will absorb the oil produced in smoking, and will not so readily get hot and bitter as a hard, short, and slender-stemmed pipe. All pipes coated with so-called meerschaum and other washes should be avoided, as these help to destroy the porosity of the clay. Much finer and more expensive pipes are made of meerschaum, a somewhat plastic magnesian stone of a soft greasy feel. This material is found in several parts of Europe (in Moravia, Piedmont, and the Crimea), but more abundantly and of finer quality in Asia Minor. Meerschaum pipe making is carried on to the greatest extent by the Germans, and Vienna may be said to be the centre of the manufacture. Sometimes the bowl alone (which is frequently artistically carved) is of meerschaum, the stem being of wood, the best sorts of which are got from the young stems of the Mahaleb cherry, grown near Vienna, the mock orange of Hungary, and the jessamine sticks of Turkey. The stem, whether of the same material as the bowl or of wood, is usually provided with a mouthpiece of ivory, silver, or amber, the last being preferred. Meerschaum pipes of the best workmanship have been known frequently to command the price of 100 guineas. Briar-root pipes, with the bowl and stem of one piece of wood, and provided with amber, ivory, or bone mouth-pieces, are now very common; they have little or no advantage over the clay pipe except in being less liable to break. Many Germans and Dutchmen prefer pipes with porcelain bowls, which are sometimes beautifully painted in the style of fine chinaware painting. The eastern hookah is a pipe of great size, the bowl of which is set upon

an air-tight vessel partially filled with water, and has a small tube which passes down into the water; the long flexible smoking-tube is inserted in the side of the vessel. By exhausting the air in the smoking-tube, the smoke is forced down through the water, and entering into the space above it passes into the stem, cooled and freed from some of the most acrid properties of the tobacco. Upon the American continent pipes have been in use from a very remote period. Indian pipes, with elaborately-carved soapstone bowls and ornamented wooden stems, or entirely of baked clay, have been found in the ancient mounds of the West, together with other relics of an unknown race. See CALUMET.

PIPE-CLAY. See CLAY and PIPE (TOBACCO).

PIPE-FISHES (*Syngnathus*), a genus of fishes included in the sub-order Lophobranchii (which see) of the Teleostean order, and nearly allied to the genus *Hippocampus*, represented by the curious little fishes popularly known as 'sea-horses' (which see). As in all Lophobranchii ('tuft-gilled') the jaws of the pipe-fishes are of complete and free structure; the gills being disposed in tufts on the branchial arches, the gill-cover being large and the gill-aperture of small size. The body is covered by scales of the *ganoid* variety set lengthwise, and in the pipe-fishes is very long and tapering, and of attenuated, slender shape. No ventral fins exist, and the jaws are united to form a pipe or tube, bearing the mouth at the tip. The *Syngnathus acus* is the most familiar British species. It averages 20 inches in length. The snout is nearly cylindrical, and the mouth is destitute of teeth. The colour is yellowish, mottled with brown. The food consists of crustaceans, worms, molluscs, &c. The largest of the British species is said to attain a length of 3 feet. Other species are the *S. typhle*, *S. æquoreus*, *S. ophidion*, *S. anguineus*, and *S. lumbriciformis*.

A very curious and remarkable circumstance in connection with the pipe-fishes consists in the males of some species possessing a pouch-like fold, situated at the base of the tail, in which the eggs are contained after being extruded from the body of the females. And after the young fry are hatched they appear to continue to reside within this pouch for a longer or shorter period, thus forcibly reminding one of the analogous arrangement seen in the kangaroos and other marsupial Mammalia. It has also been stated that if the young be shaken out of the pouch into the water, they will return into it on the body of the parent being held in the water so as to allow them to enter. The eggs, it is believed, are extruded into the pouch of the males by the females—the latter possessing no analogous structure. Yarrell states that from repeated dissections he has found that the pouch-bearing pipe-fishes were invariably males; those destitute of pouches being females, possessing ovaries containing eggs. The males of other fishes (for example, sticklebacks) are well known to assist or to perform the chief part of the incubatory duties; whilst it is also remarkable that in the Hippocampidæ, near relations of the Pipe-fishes, the males also possess a pouch similarly situated to that of the Pipe-fishes, and used similarly for the deposition of the eggs and care of the young. The lining membrane of this pouch in the 'sea-horses' has also been alleged to furnish a fluid destined for the nutrition of the young.

The name Pipe-fish may also be applied to the members of the genus *Fistularia*, included in the Acanthopterous division of the Teleostei. The bones of the face are prolonged to form a tubular structure, at the extremity of which the mouth opens. The *Fistularia tabacaria* of the Antilles, averaging about 3 feet in length, represents this genus.

PIPERACEÆ, a natural order of shrubby or herbaceous exogenous plants, inhabiting the hottest parts of the globe, particularly India and South America. They have articulated stems, leaves opposite (sometimes alternate by abortion of one of the pair of leaves) or verticillate, exstipulate or stipulate, and spiked or racemose flowers. The flowers are hermaphrodite, and supported on a bract. Stamens 2–3–6, arranged on one side or all round the ovary; anthers one or two celled. Ovary solitary, free, one-celled. The wood is often arranged in wedges, with medullary rays, but without concentric zones. There are twenty-one known genera and above 600 species. The plants of this order have pungent, acrid, and aromatic properties. Most of them contain an acrid resin and a crystalline principle called piperine (see PIPERINE). Some are narcotic and astringent. The dried fruiting spikes of *Piper longum*, an Indian creeper, are the long-pepper of commerce. Of late, however, the genus *Piper* has been subdivided, and this kind of pepper has been referred to various species of a new genus, *Chavica*, namely, *C. peepuloides*, *Roxburghii*, and *officinarum*. The dried unripe fruits of *Piper nigrum* constitute black pepper. (See PEPPER.) The fruit of *Cubeba officinalis* (*Piper Cubeba*), a climbing plant of Java and other Indian islands, is the Cubeb pepper used extensively in arresting discharges from mucous membranes. (See CUBEBS.) The leaves and unripe fruit of *Piper angustifolium* constitute the aromatic, fragrant, and astringent substance called *matico* or *matica*, which has been recommended for checking hemorrhage. The leaves of *Piper Betel* (*Chavica Betle*) are chewed in the East as a means of intoxication. (See BETEL.) The root of *Macropiper methysticum* is the *kava* of the South Sea Islanders, and is used in the preparation of a stimulating beverage.

PIPERIC ACID, PIPERIDINE, and PIPERONAL. These names are given to three substances obtained indirectly from pepper. When piperine (which see) is boiled with caustic potash and alcohol potassium piperate is produced, from which piperic acid may be obtained by the action of hydrochloric acid. This acid has the formula $C_{12}H_{10}O_4$; it forms yellowish needles, which are nearly insoluble in water. By oxidizing the foregoing acid in neutral solution with potassium permanganate, colourless, transparent, long, lustrous prisms of piperonal are obtained. This body is the aldehyde of piperic acid; it has the formula $C_8H_6O_3$. If piperine be heated with soda lime a volatile base is obtained in the form of a colourless, mobile liquid, with an ammoniacal odour and a caustic taste; to this body, which is represented by the formula $C_5H_{11}N$, the name of piperidine is given.

PIPERINE ($C_{17}H_{19}NO_3$), an alkaloid contained in pepper, from which it is prepared by exhaustion with alcohol, &c. Piperine is a crystalline, colourless substance, insoluble in water, but dissolved by hot alcohol; the alcoholic solution has a very hot taste. Piperine unites with several acids to form well-defined salts.

PIPISTRELLE (*Vespertilio Pipistrella*), a genus of bats included in the family of the Vespertilionidæ or True Bats, and in the Insectivorous section of the Cheiroptera or Bat Order. The Pipistrelle is the familiar little bat which occurs throughout Britain, and flits about during twilight. It is also said to occur in Africa and India. It is of small size, and possesses a mouse-like body covered with hair, from which resemblance its popular name of Flitter-mouse has been derived. It feeds upon insects of various kinds, which it pursues on the wing; but it is also partial to meat, and has been found in larders and pantries feeding upon joints. The Pipistrelle inhabits the crevices of walls and old buildings through-

out the day. It passes the winter, like most other bats, in a state of torpidity; but appears to hybernate for a shorter period than other and larger species. The molar teeth are provided with sharp cusps, as in Insectivorous forms generally. The nose has no leaf-like appendages. The wing membrane or patagium (which see) measures about 8 inches in expanse (Pl. XXXVIII.–XXXIX. 12).

PIPIT, or TITLARK (*Anthus*), a genus of Perching-birds, possessing also striking affinities with the true (Conirostral) Larks, which they resemble chiefly in the large size of the hinder claw, and the development of the tertiary quills. Most commonly, however, the Pipits are made to form a genus of Dentirostral Perchers, and thus belong to the sub-family of the Motacillinæ or Wagtails, which they closely resemble in their habits of running swiftly on the ground. Their food consists chiefly of insects. The bill is of moderate length, and slender, with the tip of the upper mandible notched and curved. The wings are long and pointed, the tertiary feathers being of great length. The tail is also elongated. The Meadow Pipit or Titlark (*Anthus pratensis*) is the commonest British species. The Shore Pipit, or Rock Lark (*A. petrosus*, not to be confounded with the American Shore Lark, one of the true Larks), frequents the sea-beach, and feeds on molluscs and Crustacea. The Tree Pipit or Titlark (*Anthus arboreus*) has a shorter curved hinder claw than the others. It is a summer visitant only in the British Isles. All the Pipits build their nests on the ground. The song in all consists of a clear, simple note, that of the Tree Pipit being imitated by the words *pit-pit*. See also LARK.

PIPPIN, the name given to a certain class of dessert apples, probably because the trees were raised from the pips or seeds, and bore the apples which gave them celebrity without grafting. They seem to have been introduced into Great Britain from France, and were little known there until about the end of the sixteenth century. In the time of Shakspere pippins were delicacies for the dessert: Sir Hugh Evans, in the Merry Wives of Windsor, says, 'I will make an end of my dinner—there's pippins and cheese to come.' Justice Shallow, in his invitation to Falstaff, says, 'You shall see mine orchard, where, in an arbour, we will eat a last year's pippin of my own grafting.' The Ribston, Golden, Newton, and the small Scotch Oslin or Arbroath Pippin are favourite varieties.

PIQUET, a game at cards played between two persons with thirty-two cards, all the plain cards below seven being thrown aside. On the cards being shuffled the players cut for deal; the party drawing the lowest card has to deal first. The cards are then dealt two by two until each player has twelve cards, the eight remaining undealt (called the stock) are laid on the table between the players. The first hand (the non-dealer) must then discard five or less of his cards (he must discard at least one), exchanging them for an equal number drawn from the stock; the younger hand (the dealer) may exchange from the stock three or less, but may refuse to exchange altogether. In playing, the cards rank in order as follows: the ace (which counts eleven), the king, queen, and knave (each of which counts ten), and the plain cards, each of which counts according to the number of its pips. The player who first reaches 100 has the game. The score is made up by reckoning in the following manner:—Carte blanche, the point, the sequence, the quatorze, the cards, and the capot. Carte blanche is a hand of twelve plain cards, and counts ten for the player who holds it. The point is the suit of highest value, the value being determined by the number it makes up when the cards held are added together; thus, if a player holds ace, king, ten, nine, and eight, his point would be forty-eight. The first player having called a point, the younger hand must then say whether his point is superior, equal, or inferior in value to his opponent's, by calling in the first place 'good,' in the second 'equal,' and in the last 'not good.' If the elder hand's point is 'good' he at once shows it, and counts one for each card in it, except with the points thirty-four, forty-four, fifty-four, and sixty-four, which count one less than the number of cards. If the points are equal he counts nothing. The sequence is composed of a regular succession of cards in one suit, and the highest sequence (that containing the greatest number of cards, or if the hands are equal that of the two which begins with the highest card), if of three cards, counts three; of four, counts four; of five, counts fifteen; of six, counts sixteen; of seven, seventeen; and of eight, eighteen. The quatorze is composed of four aces, four kings, four queens, four knaves or four tens, and counts fourteen. Should there not be a quatorze in either hand, the highest series of three or two is counted, but it adds only three to the holder's score. The holder of the highest sequence, quatorze, or trio counts all his inferior sequences, quatorzes, or trios, while those of his opponent do not count. The hands are played as follows:—After the elder hand counts his points he lays a card; the younger hand must lay a card of the same suit if he has it, but may lay any card in it he chooses. The highest card in the suit takes the trick. The winner of the trick has next lead, and the hands are played out as in whist. Each player for every card he leads above a nine counts one, and the second player also counts one for every card above a nine with which he wins a trick. The winner of the last trick counts two for it if gained by a card above a nine, and one if with one below it. The winner of the greatest number of tricks counts ten in addition (the 'cards'), if he holds all the tricks he counts forty in addition (the 'capot'). If a player scores twenty-nine in hand and one for the card he leads, before his opponent counts anything, he at once adds thirty to his score; this is called 'pique.' Should a player score thirty by the cards in his hand, by scores that reckon in order before his adversary can count, he obtains the 'repique,' which enables him to add sixty to his score. For the sake of convenience the scores are generally recorded at the end of the hand; but they are recordable no matter by which hand they are made, according to the following table of precedence: 1, carte blanche; 2, point; 3, sequences; 4, quatorzes and trios; 5, points made in play; and 6, the cards. If one player scores a hundred before the other obtains fifty he wins a double.

PIQUÉ-WORK, a fine kind of inlaid work, resembling Buhl-work (which see), but much more expensive and elaborate, the inlay being minute pieces of gold, silver, and other costly materials. It is confined to articles of small size, such as card-cases, snuff-boxes, &c.

PIRACY is the crime of robbery and depredation committed upon the high seas. It is an offence against the universal law of society, a pirate being, according to Sir Edward Coke, *hostis humani generis*. As, therefore, he has renounced all the benefits of society and government, and has reduced himself to the savage state of nature, by declaring war against all mankind, all mankind must declare war against him; so that every community has a right, by the rule of self-defence, to inflict that punishment upon him which every individual would, in a state of nature, otherwise have been entitled to do for any invasion of his person or personal property. By various statutes in England and the United States of America

other offences are made piracy. Thus, if a subject of either of these nations commits any act of hostility against a fellow-subject on the high seas, under colour of a commission from any foreign power, this is an act of piracy. So if any captain of any vessel, or mariner, run away with the vessel, or the goods, or yield them up to a pirate voluntarily, or if any seaman lay violent hands on his commander, to hinder him from fighting in defence of the ship or goods committed to his charge, or make a revolt in the ship, these offences are acts of piracy by the laws of England. By the statute of 8 George I. cap. xxiv. the trading or corresponding with known pirates, or the forcibly boarding any merchant vessel (though without seizing her or carrying her off), and destroying any of the goods on board, are declared to be acts of piracy; and by the statute 18 George II. cap. xxx. any natural born subject or denizen who, in time of war, shall commit any hostilities at sea against any of his fellow-subjects, or shall assist an enemy on that element, is liable to be punished as a pirate. By statute of George II. cap. xxv. the ransoming of any neutral vessel, which has been taken as a prize, by the commander of a private ship of war, is declared to be piracy. By the act of Parliament, passed March 31, 1824, the slave-trade is also declared to be piracy. In the time of Richard I., by the laws of Oleron, all infidels were regarded as pirates, and their property liable to seizure wherever found. By the law of nations the taking of goods by piracy does not divest the actual owner of the property. By the civil institutions of Spain and Venice ships taken from pirates become the property of those who retake them. Piracy, with intent to murder, stab, or wound, is capital, and pirates can gain no rights by conquest. It is of no importance, for the purpose of giving jurisdiction in cases of piracy, on whom or where a piratical offence is committed. A pirate, who is one by the law of nations, may be tried and punished in any country where he may be found; for he is reputed to be out of the protection of all laws. But if the statute of any government declares an offence, committed on board one of their own vessels, to be piracy, such an offence will be punished exclusively by the nation which passes the statute. In England the offence was formerly cognizable only by the admiralty courts, which proceeded without a jury, in a method founded upon the civil law. By the statute 28 Henry VIII. cap. xv. it was enacted that piracy should be tried by commissioners nominated by the lord-chancellor, but this mode of trial was altered by several statutes, more especially by 4 and 5 William IV. cap. xxxvi. and 7 and 8 Vict. cap. ii. The latter enacts that any justices of assize, or oyer and terminer, or jail delivery, may try piracy.

Piracy, in the common sense of the word, is distinguished from privateering by the circumstance that the pirate sails without any commission, and under no national flag, and attacks the subjects of all nations alike; the privateer acts under a commission from a belligerent power, which authorizes him to attack, plunder, and destroy the vessels which he may encounter belonging to the hostile state. He is not regarded as a pirate by the laws of nations, but in accordance with these is bound to observe certain rules and restrictions. Thus, he is debarred from attacking the vessels of the enemy while lying in any port or haven under the protection of a friendly or neutral state. See article PRIVATEER.

PIRÆUS (Greek, *Peiraieus*), the principal port of both ancient and modern Athens, is situated about 5 miles from the city, on a peninsula of the same name. It has three harbours; two on the east side, anciently named Zea (now Stratiotikí) and Munychia (now Phanari), and one on the west side, called simply Piræus, or the Harbour. This harbour, the largest of the three, was anciently divided into two parts, the one on the right Cantharus, which was appropriated to war-ships, and the one on the left Emporium, which was occupied by merchant vessels. Previous to the Persian war the principal Athenian port was Phalerum, which was not situated on the Piræan peninsula at all, but lay to the east of Munychia; but Themistocles, seeing the natural advantages of the Piræus, surrounded the peninsula with a line of fortifications. The celebrated Long Walls which connected the port with the capital, were begun under the administration of Pericles in 457 B.C., and finished in 431. They were destroyed by the Spartans at the end of the Peloponnesian war, were rebuilt by Conon, and in later years were allowed to fall into decay. The ancient town possessed a considerable population, and many noble public and private buildings. The modern town, which is connected with Athens by a carriage road, and which has risen up since 1834, contains over 1000 houses, many of them handsome. The port, though rather difficult of access, has great depth, and was recently provided with a quay capable of accommodating a large number of vessels. Pop. (1879), 21,055.

PIRANESI, GIOVANNI BATTISTA, a celebrated architect, engraver, and antiquary, was born at Venice in 1720. He passed the greater part of his life at Rome. His earliest work, published in 1743, consists of designs of his own, in a grand style, and is adorned with views of Rome. His other works, are, Antichità Romane, or Roman Antiquities, in 220 plates, with descriptions in Italian (four vols. folio); Fasti Consulares Triumphalesque Romanorum; Del Castello dell' Acqua Giulia (twenty-one folio plates); Antichità d'Albano e di Castel Gandolfo (fifty-five plates); Campus Martius Antiquæ Urbis (fifty-four plates); Archi Trionfali antichi Tempj ed Amfiteatri (thirty-one plates); Trofei d' Ottaviano Augusto (ten plates); Della Magnificenza ed Architettura de' Romani (forty-four plates); Architetture Diverse (twenty-seven plates); Carceri d' Invenzione (sixteen plates), and about 130 views of modern Rome. His inventions display much grandeur and fertility; but his representations of real objects are not always faithful, on account of the scope which he gave to his imagination. He died in 1778. Two sons, Francesco and Pietro, settled at Paris, continued his works, amounting to twenty-three vols. folio.

PIRANO, an Austrian seaport, Illyria, on a peninsula in the bay of Largone, 13 miles south-west of Trieste. It has narrow streets, with an old dilapidated castle, and a shallow harbour, admitting coasters only, though there is good anchorage for the largest vessels in the well-sheltered roadstead. The principal objects of commerce are wine and olive-oil. Pop. (1880), 7387.

PIRITHOUS, in Greek mythology, son of Zeus and Dia, wife of Ixion, king of the Lapithæ, and friend of Theseus. He married Dejanira or Hippodamia, daughter of Atrax, a prince of the Lapithæ, by whom he had Polypœtes. His marriage is famous for the battle of the Lapithæ and Centaurs, occasioned by the attempt of a drunken Centaur (Eurythion) to do violence to the bride, and which resulted in the expulsion of the Centaurs from Pelion. After the death of his wife Pirithous went to Athens, and with Theseus, who had also lost his wife, carried off Helen from Sparta. Having reached Athens, they cast lots for her, on condition that he who was successful should aid the other in procuring a wife. She fell to Theseus, whom Pirithous required to aid him in the rape of Proserpine, wife of Pluto. The two friends, therefore, descended into the infernal regions, but having sat down to rest, they were

unable to rise again. Theseus was afterwards set free by Hercules, but Pirithous remained in the infernal world loaded with 300 chains, or, according to some, was torn in pieces by Cerberus.

PIRMASENZ, a town of Bavaria, in the circle of Pfalz, 22 miles west-south-west of Landau. It is walled, well built, has several churches, a synagogue, and Latin school; manufactures of shoes, musical instruments, straw hats, and mirrors. Pop. 12,039.

PIRNA, a town of Saxony, circle of Dresden, and 10 miles from the city of that name, on the right bank of the Elbe. It is walled, and entered by two gates, has a court of law, several public offices, churches, and an orphan asylum; building docks, some shipping; manufactures of iron-plate, stoneware, chemicals, cigars, beer, &c.; and a considerable trade on the Elbe. A little above the town, on a lofty rock, stands the castle of Sonnenstein, originally a fortress and state prison, and now converted into a lunatic asylum. Pop. 11,680.

PIRON, ALEXIS, a celebrated French wit, poet, and dramatist, born at Dijon in 1689, was the son of an apothecary. He took his degrees in the faculty of law at Besançon, and was about to be admitted to practice, when his parents experienced a reverse of fortune, which obliged him to relinquish his design. He remained some time at Dijon, leading a life of dissipation, in the midst of which his literary efforts were confined to the production of a few satirical epigrams. At length he became clerk to a financier, whom he quitted to go to Paris, where he was employed as a copyist, with a salary of forty sous a day. This irksome situation he soon relinquished, and it was with difficulty that he obtained the payment of his pitiful salary. He was next engaged to write for the Theatre of the Comic Opera, and his first piece was Arléquin Deucalion, composed in two days. His success induced him to persevere, and after writing several pieces, he produced in 1738 his *chef-d'œuvre*, Métromanie, a comedy which Laharpe characterizes as excelling in plot, style, humour, and vivacity almost every other composition of the kind. Piron afterwards wrote Fernand Cortes, a tragic drama, and some other pieces, which obtained some success. In the latter part of his life he made repeated attempts to gain admission into the French Academy; but Louis XV. was induced by a mean intrigue got up by several disappointed authors to withhold his sanction to the election, and Piron was finally rejected. He revenged himself for his disappointment by calling the Academy *Les invalides du bel esprit*, and composing the humorous epitaph,

> 'Ci-gît Piron, qui ne fut rien,
> Pas même académicien.'—
>
> Here lies Piron, who was nothing—
> Not even an Academician.

To console him for the want of the king's favour Madame de Pompadour gave Piron a pension of 1000 livres. His death took place January 21, 1773. Shortly before his death he became blind and deeply penitent, which did not, however, prevent the incessant flow of *bons mots* and epigrams. Almost the last act of his life was the composition of three epigrams in answer to those which Voltaire (his rival in this department of literature) would be likely to make on him on the news of his death. His *bons mots* were collected and published in one volume 18mo; and his Poésies Diverses were printed at Neufchâtel, 1775 and 1793, 8vo. His works entire form seven volumes octavo, in the edition of Rigoley de Juvigny, 1776.

PISA (the ancient *Pisæ*), a town of Northern Italy, capital of the province of the same name, situated 6 miles from the sea, and 44 miles west of Florence, on the railway thence to Leghorn, on both banks of the Arno, here crossed by three stone bridges for general traffic, and one carrying the railway. It is surrounded by walls and ditches, defended by a citadel, entered by five gates, and forms a circuit of nearly 6 miles, much of the space inclosed being unoccupied. The river is lined by handsome quays; the streets, though not straight, are spacious and well paved; and the houses are always substantial, often elegant, and remarkable for the profusion with which marble has been employed in their construction. The most remarkable edifices and establishments are the Duomo or Cathedral, begun in 1063, consecrated in 1118, one of the noblest ecclesiastical structures of Italy, built of marble, in the form of a Latin cross, surmounted by a lofty elliptical dome, supported by seventy-four pillars. The paintings, sculptures, and mosaics in the interior are the work of the greatest artists of the fifteenth to the eighteenth centuries. The Baptistery, begun in 1153, by Diotisalvi, finished in 1278, is an immense rotunda, adorned with numerous columns and sculptures, and crowned by a noble dome, the top of which is 190 feet from the ground. The Campanile Pendente or 'Leaning Tower,' is of a circular shape, built of white marble, and fronted with 207 columns; its height is 179 feet, and it deviates 13 feet from the perpendicular. The question whether this peculiarity was designed or accidental still remains an open one. The probable solution is that the foundations settled during the progress of the structure, and that to remedy this defect an attempt was made to give a vertical position to the upper part. The tower contains seven bells, the heaviest of which weighs 6 tons; a stair of 294 steps leads to the top, the view from which, embracing the town and environs, the Gulf of Genoa to the west, and the Apennines to the north-east, is very beautiful. Other edifices are the Campo Santo, or cemetery, the most remarkable structure of the kind in existence, consisting of a rhomboidal court, lined with arcades of white marble, adorned with bass-reliefs, frescoes, and paintings, by the earliest Italian masters, and full of remarkable monuments; the Grand-ducal Palace; the town-house (Palazzo del Commune); the court-house (Palazzo Pretorio); the university, anciently famous, and still one of the most celebrated in Italy, with about seventy teachers and an average yearly attendance of about 600 students; the botanical garden, one of the oldest in existence; the museum of natural history, with many interesting geological specimens; the Pia Casa della Misericordia, a large, well-managed, and well-endowed hospital; the infirmary, two foundling hospitals, a house of refuge, and *monte di pietà*. Pisa is the see of an archbishop, the residence of a civil and military governor, the seat of a court of first resort, and several important public offices, and possesses several societies, economical, literary, scientific, and artistic. The manufactures consist of silk, woollen, and cotton goods; worsted and spun silks, soap, white-lead, vitriol and glass; and the trade is chiefly in corn, oil, and wood for fuel. The population, which reached 150,000 when the city was in its zenith, was in 1881 37,704. The province of Pisa has an area of 1180 square miles. The south-east and centre are occupied by ramifications of the Apennines, but the north consists of extensive plains, which become depressed towards the shore on the north-west, and contain several shallow lakes, which form large and unhealthy swamps known by the name of Maremma Pisana and Maremma Volterrana. The soil is generally fertile, and corn, wine, oil, and fruit are very abundant. Pop. 283,269.

Pisa was an ancient Etrurian city, and one of the twelve cities of the confederation. In 180 B.C. it

became a Roman colony. About the beginning of the Christian era it was a flourishing city. On the fall of the Roman Empire it was pillaged by the Goths, and afterwards subjected by the Longobards. In the tenth century it had succeeded in taking a lead among the Italian states. In 1050 the Pisans made themselves masters of Sardinia and Corsica, in 1063 destroyed the Saracen fleet near Palermo, in 1096 took part in the first crusade, and in 1117 conquered the Balearic Islands. In the intestine wars of the peninsula Pisa became the most powerful champion of the Ghibelline cause, and suffered severely at the hands of the victorious Guelfs. The protracted wars which the Pisans carried on against their rivals the Genoese led to their disastrous defeat near Leghorn, in 1283, and the peace concluded in 1300 compelled them to evacuate Corsica and other possessions. In 1326 the kings of Aragon got possession of Sardinia. The city was further weakened by internal dissensions, and fell a victim to the ambition of the condottieri. It finally came under the power of Duke Galeazzo Visconti of Milan, from whose son Florence obtained it by purchase in 1406. The city was compelled to surrender by famine, and the larger part of the citizens emigrated. But in 1494, when Charles VIII. of France made an expedition into Italy, Pisa rose against Florence, and for fifteen years fought gloriously for her liberty. At length the citizens were compelled by famine to submit to the Florentines (June 8, 1509), and thus ceased for ever to be independent. On the ruins of Pisa was founded the power of the Grand-duchy of Tuscany.

PISA, COUNCIL OF, a general council of the Roman Catholic Church, held in the beginning of the fifteenth century to consider the pretensions of the rival popes of Avignon and of Rome. This council was opened at Pisa, 25th March, 1409, and was composed of twenty-two cardinals, four patriarchs, twelve archbishops, eighty bishops, together with representatives of twelve archbishops, 102 bishops, and a great number of doctors of theology, abbots, and other ecclesiastics, and the representatives of several kings, princes, and universities. The rival popes, Benedict XIII. (of Avignon) and Gregory XII. (of Rome) were summoned to appear within a stated period, but they refused to comply. After mature deliberation both popes were formally deposed, and Cardinal Pietro Philargi, archbishop of Milan, was elected. The authority of the council was not, however, generally recognized, and it was not until 1417 that the schism can be said to have terminated.

PISANO, NICCOLA, a sculptor and architect, born at Pisa about 1205, spent the most of his life there, and died in 1278. He holds an important place in the history of Italian art, inasmuch as his works presented a sudden and new development and far surpassed those of his immediate predecessors. Among his most famous works are the reliefs on the chancel of the baptistery of Pisa, the choir of the cathedral of Siena, and the beautiful sarcophagus of St. Dominic in Bologna. His chief architectural works are churches in Pisa, Pistoja, and Volterra.—GIOVANNI, the son and scholar of Niccola Pisano, was born in 1240, and died in 1320. He laid out the famous Campo Santo, in Pisa, executed the monuments of Urban IV., Martin IV., and Benedict XI. in the church of Perugia, built the front of Siena cathedral, and produced a richly sculptured altar in the cathedral of Arezzo.—Another son, ANDREA PISANO, the friend of Giotto, executed the statues on the belfry of Florence cathedral, and the beautiful bronze doors of the baptistery there.

PISCES, or FISHES. See ICHTHYOLOGY.

PISCES (the Fishes), a sign of the zodiac, which is entered by the sun about the 19th of February. The constellation which occupies the zodiacal region corresponding to the sign has the same name; it contains some interesting double stars.

PISCICULTURE, the art of artificially hatching and rearing fish. During recent years the hatching of fish from artificially fertilized eggs has, owing to the alleged decrease in the number of useful fishes, attracted great attention both in Europe and in America. Before the process of artificial impregnation was discovered fishponds existed in most countries for rearing fish, while for many centuries the Chinese have been in the habit of hatching fish from naturally fertilized eggs. It may be taken for granted that as long as there was an abundant supply of fish no attempt was made either to protect them or to increase their number by artificial means; that in fact it was only when a great increase in the population led to a scarcity of fish and other kinds of food that man recognized the necessity of doing something to meet the increased demand for fish, either by guarding against the pollution and the overfishing of the most productive waters, and by increasing the supply by artificial means, or both. China and Egypt may be mentioned as nations which at an early period were densely populated, while the United States is an example of a nation which has rapidly increased during recent times. Accordingly we find that the Chinese and the Egyptians long ago engaged, apparently with great success, in fish-culture, while at the present day pisciculture as now understood is nowhere more extensively practised than in the United States.

Judging from what takes place at the present day in China, it appears that fish-culture to the ancient Chinese meant the distribution all over the country of naturally fertilized eggs obtained by introducing twigs into, or by throwing hurdles and mats across, the rivers frequented by fish; and further, the feeding of the fry when hatched by breaking ordinary eggs over the surface of the water. In all probability a similar method was practised by the Egyptians; but, like the Romans after them, they seem to have devoted their energies chiefly to the construction of ponds in which large numbers of fish were successfully reared, apparently with considerable profit. Although the poor as well as the rich engaged largely in Egypt in what might be called *aquiculture*, it seems that in Rome nearly all the fishponds belonged to the nobles, and that they were often constructed and maintained regardless of expense. This is partly accounted for by the rich Romans being extremely partial to fish as food, and partly because fish-culture was for a time their favourite pastime—mullets, eels, and lampreys receiving the greatest possible attention and fetching sometimes fabulous sums when sold, as much as £240 having once been paid for a single mullet.

From Varro's work De Re Rustica it seems the Romans devoted much care to the construction of marine as well as fresh-water fishponds, and that the latter were often subdivided into compartments adapted for the different kinds of fish. Following to a certain extent the example of the Chinese they sometimes collected from the sea the eggs of such fish as frequented estuaries and rivers and deposited them in artificial ponds and lakes, and they occasionally introduced new fish into their waters. Optatus, *e.g.*, brought a large number of a species of Scarus from the Carpathian Sea (or sea near Crete and Rhodes), and set them free in the Bay of Naples, and protected them from the fishermen for several years. From monastic and other records it is evident that fishponds were more or less common until comparatively recent times both in Britain and on the Continent of Europe, and it may be predicted, now that great

advances in the art of fish-culture have been made, that they will soon again increase in number. Although a form of fish-culture reached a great development in ancient times, what we now usually understand by fish-culture, that is the hatching of fish from artificially fertilized eggs, is practically a modern invention. This discovery is said to have been made in the fifteenth century by Dom Pinchon, a Portuguese monk; but if he really made the discovery no practical results followed, and to Jacobi, a wealthy German gentleman of Westphalia, we are indebted for the first impulse in the right direction. The results of many experiments made by Jacobi on his estate at Hohenhausen were made known in France in 1770, and in England some eight years later. Although the British government appreciated Jacobi's discovery sufficiently to grant him a pension, no great advance was made until 1837, when John Shaw of Drumlanrig, in the south of Scotland, made experiments on the Nith, and succeeded in rearing trout from artificially impregnated eggs, and at the same time in increasing our knowledge of the life-history of the salmon. In 1841 Remy, a French peasant in the Vosges department, having been struck with the failure of the fish supply, began to study the habits of trout during the spawning season. With the assistance of a companion (Gehin) Remy made a number of experiments with trout ova, and finally succeeded like Shaw in hatching trout from artificially fertilized eggs; but Remy and Gehin were more fortunate than Shaw, in as far as their work was taken up and extended by the French government, who, in 1848, constructed the great hatchery of Huningue, near Basel, which has, to a great extent, been the means of restocking the once impoverished French lakes and rivers. Soon after the Huningue hatchery had been established under the direction of Professor Coste, several similar institutions were formed in Germany and Britain, and at a late date in the United States and Canada, and nearly all countries have now provided themselves with hatching stations. One of the earliest of these establishments is the Stormontfield hatchery on the Tay, which was begun in 1853; but the most perfect as well as the most celebrated is the one recently erected by Sir James Gibson-Maitland at Howietoun, near Stirling.

Fish-culture is now, however, no longer chiefly confined to salmon and trout. Since the appointment of the United States Fishery Commission in 1871 successful experiments have been made in the artificial cultivation of shad, cod, and other sea-fish, and also with oysters and clams; while the hatching of other molluscs, and of lobsters and other crustacea, is or has already been attempted in several countries, so that pisciculture now occupies a large and ever-increasing field of usefulness. Indeed it may now be said to include not only the hatching of useful fishes but also the introduction of new forms, and the study of their habits and life-history, and in the case of the salmon and allied forms the providing of facilities when necessary to enable them to reach their spawning ground.

The importance of the discovery of the method of artificial impregnation will be at once evident. In the higher vertebrates (birds, reptiles, and mammals), living in natural conditions, very few eggs reach maturity at a time, and usually all the eggs are fertilized and to a great extent protected during the development of the embryo, and the young when they appear are often carefully tended and fed. In the case of most fish, on the other hand, it seems that often comparatively few of the numerous eggs produced are fertilized, and during the whole of the developmental process they are absolutely unprotected, and the fry have not only to protect themselves as best they can from a multitude of enemies, often including the older members of their own family, but they have further to obtain unaided their own food. It is owing to this want of protection that so many fish, in order to have a chance of surviving, have to produce an enormous number of eggs —some, such as the cod, turbot, and sturgeon, forming several millions every season. It is because of this richness in eggs that so much is possible to the pisciculturist, and that without much trouble he may, when he desires, more than make amends for the disturbance of the balance that results from his capturing annually many millions of the various food fishes. It is well known how rapidly hares and rabbits multiply when their surroundings are favourable, and it can be easily understood that in order to increase any given fish to an almost unlimited extent it is only necessary (1) to ensure that a large percentage of the eggs produced are fertilized, and (2) that the eggs and afterwards the young fish are protected; and the longer the protection of the young, the greater the chance of maturity being reached. Sometimes no attempt is made to protect the fry; the eggs when well advanced in development are turned out, or the fry are allowed to escape almost as soon as they are hatched. This system has been especially carried on in Canada and the United States, and, although it may give excellent results in some instances, there is always an element of uncertainty about it. In the case of salmon the 'eyed' ova may never hatch, or the fry when hatched by artificial means may be (owing to overcrowding, changes in the temperature, or other causes) too weak to survive. Hence, until it has been proved that the method of hatching adopted gives strong well-formed fry, it is usually better not only to keep the eggs until they hatch, but also to protect the fry until they are well able to care for themselves. In this way double protection is as it were given. By taking the milt and roe from the breeding salmon and hatching the eggs in such a way that weak fry incapable of surviving are produced, pisciculture may be the means of diminishing rather than of increasing the number of fish in any given river; whereas if healthy feeding fry are introduced into a river, there cannot be much doubt as to the result. When an attempt is made to protect the fry as well as the eggs, the question of feeding at once arises. For years the difficulty of providing suitable food for salmon fry in a convenient form seemed insurmountable, but now this difficulty has been completely overcome, chiefly through the perseverance and ingenuity of Sir James Gibson-Maitland, who has carried salmon culture to so wonderful perfection that he is able not only to fertilize and hatch 98–99 per cent of the eggs obtained, but also to rear almost all the fry hatched until ready for migrating to the sea. While the remarkable results obtained at Howietoun prove conclusively not only the possibility but also the great advantage of engaging in salmon culture, results obtained elsewhere are not so satisfactory. This is in all probability due to those in charge being more anxious to report a large number of eggs hatched than to produce strong healthy fry; hence in future, in the case of salmon, we shall come to judge of the success attained not so much by the number of eggs hatched as by the number of well-formed, vigorous fry introduced into the rivers.

Fish-culture, chiefly through the enlightened policy of the government of the United States in providing liberal supplies to the Fish Commission appointed in 1871, is now recognized as an important industry. It is, however, an industry which, in the case of the sea fisheries at least, requires at the outset the expenditure of large sums of public money, and which, in

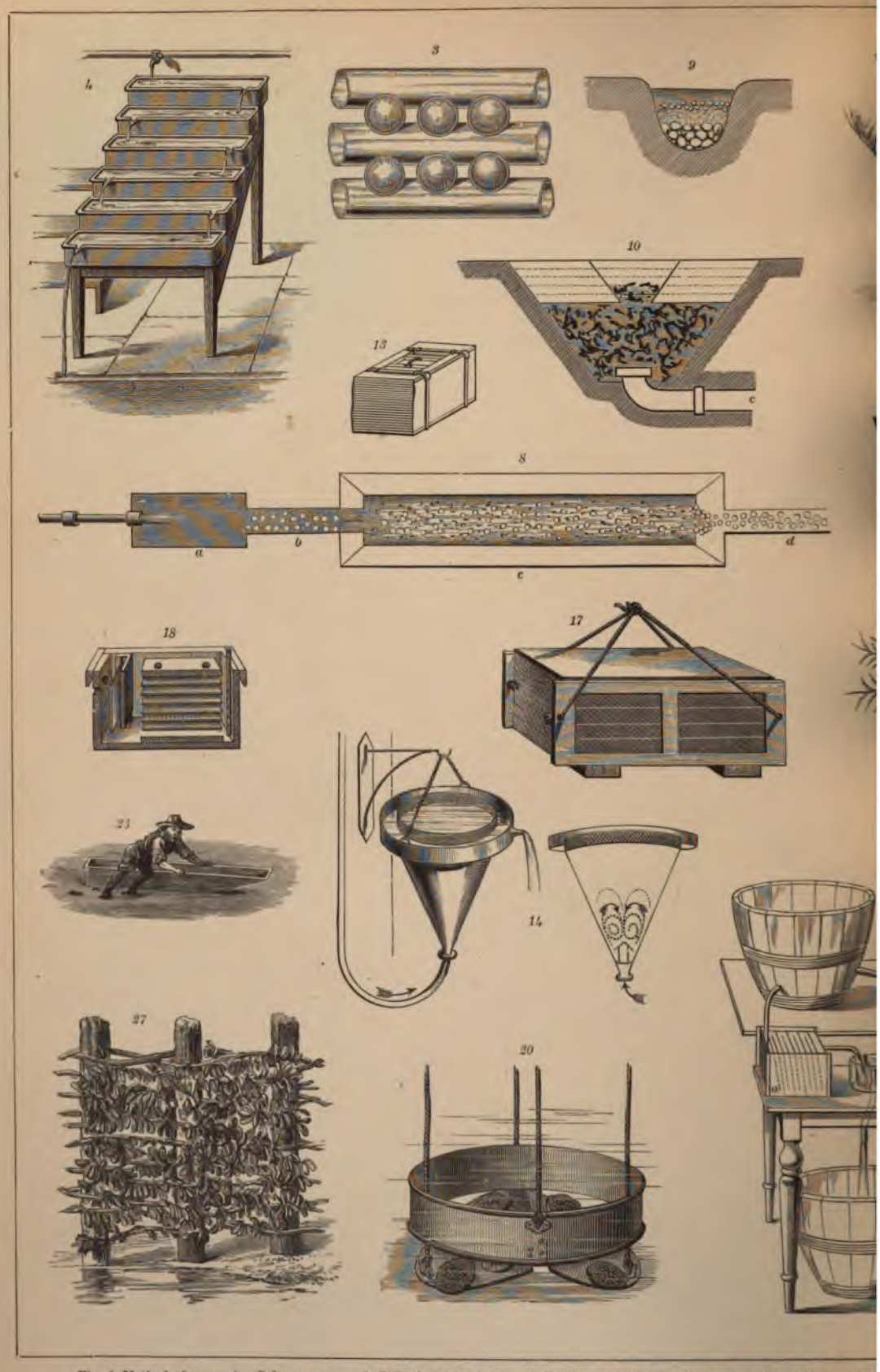
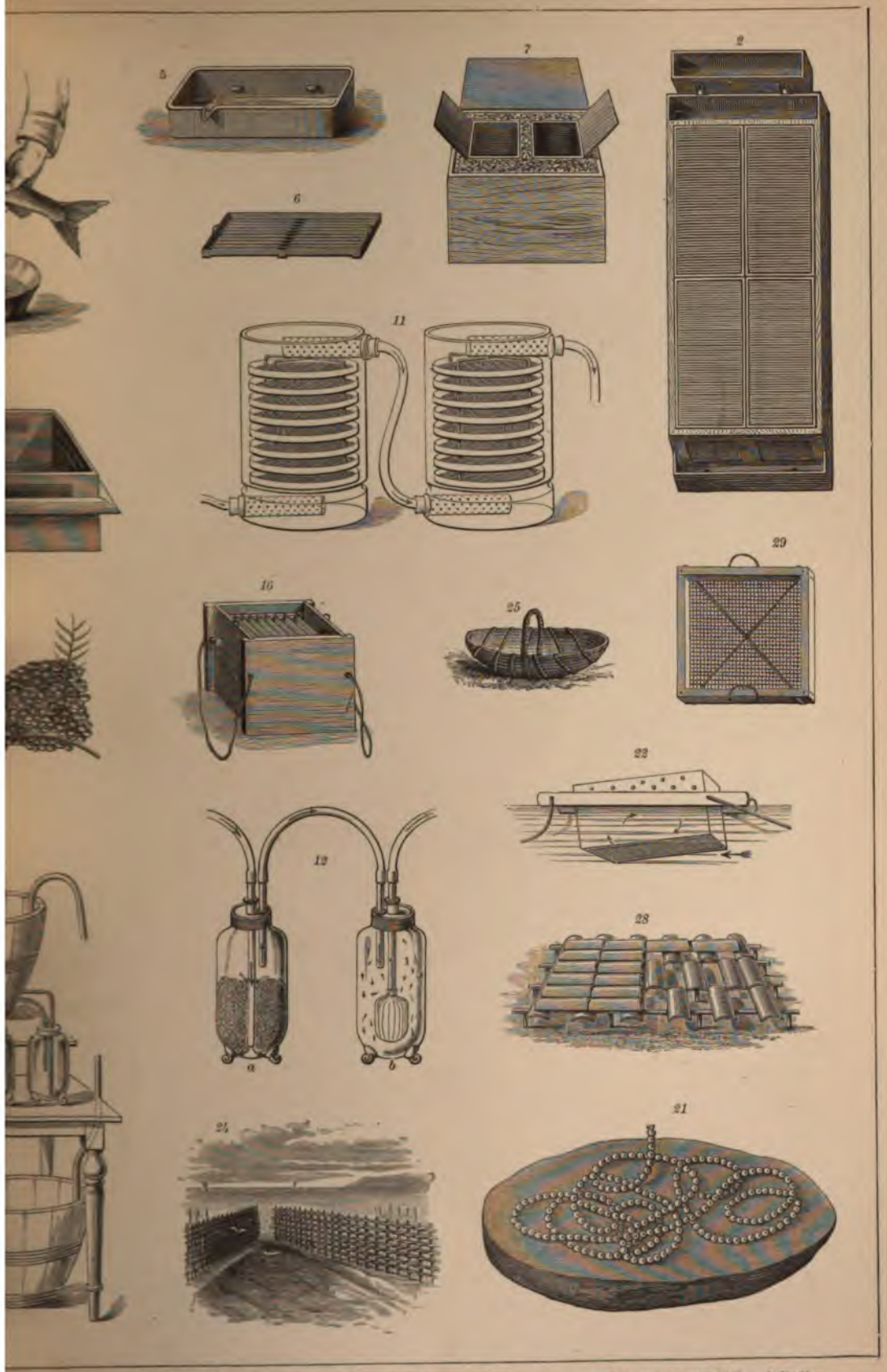


Fig. 1. Method of expressing Salmon eggs. 2. Grille hatching box. 3. Portion of Grille showing eggs on glass tubes 4. I
of "redd." 10. Section of fry pond. 11. Ferguson's hatching jars. 12. M'Donald's hatching jars. 13. Crate for
-sive eggs in deep water 18. Box for hatching adhesive eggs. 19. Adhesive eggs attached to sea fir. 20. Tray
ching, &c., in sea-water. 24. Wattles for mussel culture. 25. Basket for collecting mussels. 26. Mussel fishe



troughs. 5. Single trough. 6. Grille for do. 7. Transporting box for Salmon eggs. 8. Diagram of a "redd." 9. Section
14. Bell & Mather hatching cone. 15. Wave hatching box. 16. Box for carrying adhesive eggs. 17. Box for hatching
eggs on spawning bank. 21. Ribbon of eggs expressed from herring. 22. Shad hatching box. 23. Simple arrangement
trough. 27. Wattles covered with mussels. 28. Tiles used in oyster culture. 29. Frame used in Oyster box collector.

order to be of any real service, will require to be conducted on a very large scale. Statistics might be given to indicate what has already been done, but at the best they are far from satisfactory. It will be better to mention two examples of the results gained. By introducing two millions of young fish, during five consecutive years, into the Sacramento River, California, the catch was increased from five millions to fifteen millions of pounds. Again, by introducing young cod into Gloucester harbour, Massachusetts, it has been shown that even the supply of migratory sea fish can be influenced, for deep-sea cod are now taken in the harbour where they were never found before. As an indication of the great possibilities of fish-culture in the future, it may be mentioned that already the eggs of twenty-nine species of food fishes have been artificially fertilized and hatched, and that recently it has been discovered how to successfully manipulate the eggs of the valuable American oysters and clams. Further, it is now possible to arrest for a time the development of the eggs of fish, and forward eggs in perfect safety not only across the Atlantic, but to the most remote countries; while young fish can easily be conveyed from one side of the American continent to the other. The natural movements of salmon and other fish have now been facilitated on various rivers by the erection at falls and cataracts of suitable fish-ways, the Macdonald fish-way having already opened up many miles of valuable spawning ground.

In an article of this kind it is impossible to discuss at length the various methods adopted for hatching the different kinds of fish eggs, far less to give an account of the numerous hatching boxes that have been used in different countries. It will be sufficient to indicate shortly how the hatching of some of the common food fishes is carried on.

Although the eggs of fishes vary greatly in form and number, they can be readily arranged under one of four groups, viz.: (1) Eggs which sink, for example, those of the salmon. (2) Eggs which float, as those of the cod. (3) Eggs which are semibuoyant, as those of the shad; and (4) Eggs which are adhesive, as those of the herring. This being the case the hatching apparatus naturally requires to be adapted for heavy, floating, and adhesive eggs.

By way of illustrating how heavy eggs are manipulated, we shall refer to one of the methods adopted for hatching salmon. In order to hatch large numbers of salmon it is necessary at the outset to provide a hatching-house. This should be as far as possible under ground, so that the temperature remains nearly constant during both summer and winter. The hatching-house should be furnished with a number of hatching-boxes and with large shallow wooden trays for rearing the fry. Each hatching-box (fig. 2, Pl. CLVI.–CLVII.) is provided with four grilles, and should be capable of accommodating about 20,000 eggs, arranged as seen in figure 3 in rows between glass tubes, which are fixed in strips of perforated zinc in such a way that they can be easily replaced. The glass grilles, instead of being arranged in groups of four in a wooden box, may be arranged in a series of earthenware troughs (fig. 4), each trough (fig. 5) being provided with a shallow spout and rests for supporting the frame (fig. 6), containing the glass tubes of the grille. Given a hatching-house with hatching-boxes, the next requisite is a supply of pure clear water, which should if possible be conducted to the hatching-house under ground. The supply of water determines the number of eggs that can be hatched—for every 100,000 trout eggs 10 gallons of water are required per minute in order to give strong vigorous fry.

The hatching-house and water supply having been arranged, and the salmon or trout selected, the female is held as seen in fig. 1, and the eggs allowed to fall into a dry pan. When a sufficient number of eggs have been obtained a small quantity of milt is expressed from the male, and the pan tilted and gently shaken so as to facilitate the diffusion of the milt. Some water is then added, and after stirring the mixture with the hand the eggs are allowed to rest for about half an hour—the time varying with the temperature. When the eggs have 'hardened' pure water is poured gently over them until all the milt is removed; they are then ready to be conveyed in a carrying-can and deposited on the grilles in the hatching-house. All that is further required is that the dead eggs should be removed as they become white. At the end of six or eight weeks the developing eggs may be removed from the grilles and packed in trays on damp swansdown or moss, and forwarded with perfect safety all over the world. A transportation box, used by Atkin for transmitting salmon eggs between layers of moss, is represented in fig. 7.

The eyed ova may either be deposited in natural or artificial *redds*, as they are called. In either case the temperature of the water should, if possible, not vary more than 5° Fahr., and unless the fry are to be fed when hatched, the redd should be in the vicinity of sufficient food. A convenient form of a redd is represented in fig. 8. It consists of a settling pond (*a*), from which the water passes through gravel (*b*) to reach the redd proper (*c*). This consists of a trench about two feet wide at the bottom and four feet at the surface, containing first a layer of stones (see section figure 9), then coarse gravel, and finally a coating of fine clean washed gravel. From the redd a channel (*d*) filled with gravel may be continued to a rearing pond. The eyed ova are deposited amongst the fine gravel on the surface of the redd. Hatching takes place about the end of April. The young fry (alevins) usually remain hidden amongst the gravel for about six weeks until the yolk-bag is absorbed, when they begin to feed. About this time they should be allowed to escape from the artificial redd into a rearing pond, and there fed until about midsummer on a mixture of beef and yolk of egg—about nine yolks to a pound of beef. A section of a fry pond is represented in fig. 10, which shows (*c*) the pipe by means of which it can be annually cleaned. After midsummer the fry begin to rise and take their food in the ordinary way; they may then be placed in an ordinary pond or introduced into a river. The fry can easily be transported for considerable distances in large tanks, and even yearlings stand a forty hours' journey remarkably well, but large trout cannot be trusted longer than ten to twenty hours in the tanks, and they require considerable attention *en route*. In the United States metal trays covered with iron wire have been substituted for the glass grilles. Five or six trays are arranged above each other like those in Ferguson's hatching jars (fig. 11), so that there is great economy of space and, notwithstanding the crowding, excellent results are said to be obtained.

Nearly all adhesive as well as all heavy eggs deposited in fresh water can be hatched in the same apparatus as salmon and trout eggs, the adhesive eggs of the smelt, *e.g.*, having been successfully hatched on glass grilles at Howietoun. The eggs of the cod, haddock, turbot, sole, and of other fish which produce floating eggs, require very different treatment from the heavy eggs of the salmon and trout. Any apparatus that prevents the eggs escaping suffices for hatching small numbers for experimental purposes. The eggs of the cod have been hatched in great numbers by the United States Fish Commission.

The eggs may either be collected in specially constructed carrying cans, or taken from live fish kept in tanks near the hatchery. Formerly they were placed in floating hatching-boxes (fig. 15), into which water entered by a wire-cloth bottom to escape by openings near the margin also guarded by fine wire-cloth, but now the eggs are usually hatched in what are known as M'Donald's hatching jars (fig. 12*a*). The water is conducted to the bottom of this jar by a glass tube, from the bottom it rises to escape by a second tube (fig. 12*a*) below the surface of the water. In this way the eggs are kept in constant motion, and yet they are not carried away by the outward current. The young cod when hatched can be collected in a similar jar by guarding the opening of the outlet tube (fig. 12*b*).

Seeing that over nine millions of eggs may be formed by one cod in a season, it can be easily understood that a very large number of young cod might readily be hatched and introduced into our territorial waters. In all probability it will be found that the eggs of the haddock, sole, turbot, and other fish may be treated in the same way as those of the cod. Hitherto it has been extremely difficult to obtain male soles, and in order to hatch young sole in any number it may be necessary to collect males and preserve them in fishponds.

Semibuoyant eggs can be readily hatched in the M'Donald jars. Many millions of shad eggs have been hatched by the United States Fish Commission. Some have been hatched in floating boxes (fig. 22), while the Bell and Mather hatching-cones (fig. 14) have been used for others. The shad eggs are taken from the fish, and having been fertilized they are transported in special crates (fig. 13) to the hatching station, where they are at once transferred to the hatching apparatus. When hatched they can be easily forwarded considerable distances in cans similar to those used for salmon fry.

Adhesive eggs may either float or sink. For some floating adhesive eggs the Bell and Mather cone (fig. 14) might suit well, while the M'Donald jar (fig. 12) might be better adapted for others. Adhesive eggs which sink have hitherto been hatched most successfully on plates of glass arranged in wooden boxes. Sometimes the sheets of glass are arranged (as in Clark's box) so that the water enters at one end of the box to escape by the other, after coming in contact with the various plates (fig. 23*a*), while in another box used by the writer the glass plates are arranged horizontally with a jet of water between each (fig. 18). Equally good results are obtained when the eggs are deposited on flat stones or pieces of sea-weed if a sufficient current of pure water is allowed to run over them.

In fertilizing small adhesive eggs, such as those of the herring, instead of following the dry method usually adopted for large eggs (*e.g.* salmon and trout), it is better to express the eggs into previously fertilized water. If the eggs are to be deposited on a glass plate, it should be held in water into which some milt has been introduced; as the eggs fall and adhere to the glass they are almost certain to be fertilized. The eggs escaping in the form of a long beaded ribbon form loops as they reach the glass plate (fig. 21); but in a short time they rearrange themselves so as to form an almost continuous layer. If allowed to fall on a piece of sea-fir they generally form a small round cluster (fig. 19). Fig. 17 shows a hatching-box adapted for sinking to various depths to test the influence of temperature, &c., on the development of adhesive eggs, while in fig. 20 an apparatus is represented for depositing stones, &c., coated with adhesive eggs on deserted spawning banks.

The cultivation of oysters is in many respects a more important industry than that of salmon, but although it has been engaged in from at least the time of Sergius Orata, who bred oysters in the Lucrine Lake in the seventh century, the method of artificially impregnating the eggs has only recently been discovered, the credit of the discovery belonging to the United States Fish Commission. Unlike fish each oyster forms both eggs and sperms, the eggs reaching maturity at one time and the sperms at another, so that cross fertilization is secured—each oyster shedding about a million eggs during the spawning season. There has not yet been time to ascertain what influence the discovery of artificial fertilization and hatching of oysters will have on increasing the supply, but it is hoped that it may be the means of restocking many of the now all but exhausted beds. Hitherto oyster-culture essentially consisted in collecting the young oysters (spat) during their free swimming stage, and rearing them either on natural or artificial banks. For many years oyster-culture has been carried on with considerable success on the French coast, and recently a number of satisfactory experiments have been made at the Zeeland oyster-beds by the Dutch government. In England and Germany oyster-culture has hitherto practically proved a failure. At Arcachon (south of Bordeaux), where the best results have been obtained, a stock of full-grown oysters has always been maintained on the banks. This has been of the first importance, because it has not yet been possible to breed oysters satisfactorily in oyster parks. The oyster-culturist at the present time devotes his energy first to collecting the spat, and next to rearing as many marketable oysters as possible from the spat collected. The spat may be collected on bundles of faggots (fascines) which are anchored on the oyster-bed. After five or six months the faggots are removed, and the young oysters, of which there may be several thousands on each faggot, are detached and deposited on the bank amongst the old oysters, or they may be used to restock an exhausted bank, or conveyed to an oyster park.

Instead of faggots platforms may be used, or the spat may be collected on frames (fig. 29), arranged in boxes through which water enters freely by the bottom, to escape by holes in the sides. When a box has been fixed by means of four stakes a number of nearly mature oysters are placed on a layer of shells under it, while others are laid on the frames after they have been similarly coated with shells. When the spat escapes it readily adheres to the shell previously laid on the frames, where it develops into oysters that in five or six months can be easily removed. The spat is sometimes collected on irregular blocks of stone and often on curved tiles (fig. 28), which have been previously coated with cement or lime to admit of the young oysters being afterwards removed without fracture of their shells. The tiles may be arranged in a single layer and retained in their place by stones, or there may be several layers; or instead of occupying a horizontal the tiles may occupy an oblique position. The spat which adheres to the hollow side of the tile may be removed and utilized for stocking either natural or artificial banks.

Another mollusc much sought after is the mussel. Mussels once existed in great abundance around the shores of Britain, more especially in the various firths and bays, but now nearly all the unprotected mussel-banks have been destroyed by over-dredging. Still not only might the banks be restocked, but many miles of mud-flats, which have hitherto provided nothing for man's use, might easily be made to yield splendid crops of mussels every season. At Aiguillon on the French coast not far from Rochelle mussels have long been cultivated by means of wattles, and no

better system than the 'wattle' system has yet been discovered. Now that it has been so thoroughly tested on the French coast, there is a chance of its being extensively used in Britain.

The young mussel, like the young oyster, after swimming about for a short time fixes itself to stones, shells, or other substances. During the free stage the young mussels usually move in and out with the tide; while this affords them an opportunity of extending their distribution, it also incurs the risk of their being carried far out to sea, where further growth is impossible. About the end of their pilgrimage they, as it were, begin to look out for a fixed abode, as near shore as possible. In many instances the sea-bottom near the shore is covered with a thick layer of mud and sand, over which they pass again and again without finding a suitable resting-place. It is in such cases that wattles, by providing a convenient surface of attachment, are so useful. In ordinary circumstances several forms of wattles are in use. 1. There is a row of stakes (*low crawls* they are called) within about a foot of each other, which are only uncovered at spring-tides, these secure many of the young mussels which otherwise would be carried out to sea. 2. There are two rows of *false crawls* in which the stakes are about 18 inches apart with the intervening spaces filled up with wickerwork. The false crawls are freely exposed during both spring and neap tides. 3. There may be two or more rows near the shore which are exposed several hours every day, and are known as *high crawls*. When the mussels on the low crawls are about the size of a bean they are collected in baskets (fig. 25), and conveyed in a small flat-bottomed canoe (an *acon*, fig. 26) to the wickerwork of the false crawls, where they are attached in bags of old netting, &c., which soon rot. When they have increased in size so as to occupy the whole of the available space provided by the false crawls (fig. 27) they are next removed to the high crawls, were they remain until they reach maturity. The wattles may be arranged so as to assume a V shape (fig. 24), with the pointed end opening towards the sea, or they may be arranged in parallel rows. The stakes should project about 6 feet above the surface of the mud, and be from 18 to 20 inches apart, while the wicker-work should consist of long thin branches capable of being closely woven between the stakes from near their top to within about 8 inches of the bottom (fig. 27). The *acon* is simply a wooden box about 9 feet in length which the fisherman pushes along over the mud, as represented in fig. 26.

Although the necessity of increasing the supply of lobsters and other crustacea has been recognized, little of a practicable nature has hitherto been accomplished. The naturally fertilized eggs of both lobsters and crayfish have been artificially hatched, and the young reared to a considerable size. In the future steps may be taken to remove and hatch out all the 'berries' found on the hen lobsters captured, and further to construct ponds for rearing crabs and lobsters until they reach a marketable size.

PISCINA, a hollow stone basin or trough, with a channel leading to the ground, placed near the altar in churches, and fixed at a convenient height above the floor. It is used to hold the water in which the priest washes his hands; and for rinsing the chalice.

PISÉ, an economical material for forming the walls of cottages, agricultural buildings, &c., consisting of stiff earthy materials well rammed into a frame, and when dry forming a good strong wall.

PISEK, a town of Bohemia, on the right bank of the Wottawa, here crossed by one of the finest stone bridges in the country, 52 miles south by west of Prague. It is surrounded by an old and lofty wall, flanked with numerous towers; is well built, and contains the remains of a royal castle. It has manufactures of linen and woollen cloth, musical instruments, potass, and iron-wire. Pop. (1880), 10,545.

PISIDIA, in ancient geography, a province of Asia Minor, bounded north by part of Phrygia, east by Isauria and Cilicia, south by Pamphylia, and west by Lycia, Caria, and Phrygia. The inhabitants were mountaineers, and were never really subdued by the Romans, being protected by the mountains and ravines which intersect the country. These fastnesses are still inhabited by a wild predatory people called Karamanians, and the country is generally little known.

PISISTRATUS (Greek, *Peisistratos*), 'tyrant' of Athens, was descended from Codrus, the last king of Athens, and was born not later than 612 B.C. He was rich, handsome, and eloquent, and being by nature ambitious he soon placed himself at the head of one of the three parties into which Attica was then divided. These were the party of the Plain, comprising the landed proprietors, then headed by Lycurgus; that of the Coast, or wealthy trading class, headed by Megacles; and that of the Highlands, mainly made up of the labouring population. This being the party that seemed most likely to further the designs of Pisistatrus he threw in his lot with it, and secured its allegiance by coming forward as the patron and benefactor of the poor. In all his public speeches he was the advocate of civil equality and a democratic constitution. Solon saw through his policy, and expressed his apprehensions of the result. They were but too soon verified. One day Pisistratus appeared in the market-place with several slight wounds, which he had inflicted on himself, and called upon his fellow-citizens to protect him against certain alleged enemies, who had, as he said, attacked his life on account of his adherence to the democracy. An assembly of the people was immediately summoned, in which Ariston, one of his friends, proposed that a guard should be given him for the security of his person. This proposal was approved, notwithstanding the opposition of Solon. A body-guard of fifty men was voted him; this force he soon greatly increased, and in 560 B.C. he seized upon the acropolis (citadel). He was now master, or, as the Greeks termed it, 'tyrant' of the city, while Solon departed from his enslaved country. But though a tyrant in the Greek sense, his use of power was by no means tyrannical. He made no attempt to abolish the wise laws of Solon, but confirmed and extended their authority. He always showed the greatest respect for the lawgiver, but his endeavours to induce him to return to Athens were ineffectual. The sovereignty of Pisistratus was not, however, secure. Megacles left Athens with his family, and entered into a correspondence with Lycurgus, for the purpose of overthrowing the power of Pisistratus. Their project succeeded, and Pisistratus was compelled to leave the city. But Megacles soon became dissatisfied with the party to which he had united himself, and offered to reinstate Pisistratus if he would marry his daughter. This proposition he accepted, and his return was soon effected. Not long after Megacles again made common cause with Lycurgus, and Pisistratus retired voluntarily to Eretria. Here he occupied himself with the education of his sons, and took measures to recover his power. Contributions were solicited from friendly cities, and were freely granted, Thebes especially surpassing all the rest in this respect. Being thus supplied with money and troops, in the eleventh year of his second banishment Pisistratus entered Attica at the head of an army, and having dispersed the troops sent against him he entered the city, and

made himself master for the third time of the sovereignty. He continued to rule with his former mildness; but, in order to weaken the popular party, he adopted a measure which was very useful to the state. He forced many of the idle inhabitants to leave the city and cultivate the country around, which by these means was covered with corn-fields and olive plantations. Those who had no resources of their own he supplied with cattle and seed. He exacted from every one the tenth part of his income and earnings, and thus increased the revenue of the state, which he expended in splendid public buildings. He established a public library, and collected and arranged the poems of Homer. As he well knew how tyranny was hated he carefully concealed his power under the exterior of a private citizen. He submitted like others to the jurisdiction of the Areopagus, before which he was accused of murder, and conducted himself with as much prudence as clemency. In this way Pisistratus exercised the sovereignty not as the oppressor but as the father of his country, which scarcely ever enjoyed a longer term of peace and prosperity. He died 527 B.C., leaving two sons, Hippias and Hipparchus, to inherit his power, who were not, however, able to preserve it. See HIPPIAS.

PISOLITE. See PEASTONE.

PISTACHIO NUT is the produce of *Pistacia lentiscus*, belonging to the natural order Anacardiaceæ, much cultivated in the Greek islands, especially Scio, where the gum named mastic is obtained from this species, as well as from *P. atlantica*. The plant is also cultivated in many parts of southern Europe. The nut is of a reddish-green tint, and about an inch long, oval and acuminate; the kernel is bright green, and has an agreeable flavour. The fruit is much used by the Turks and Greeks. See MASTIC.

PISTIL, in botany, the female organ of a phanerogamous flower, occupying almost invariably the centre of the flower. In most cases there is only a single pistil in a flower, as in the lily, hyacinth, and poppy; in other instances there are several in the same flower, as in the rose and ranunculus. It consists essentially of two parts, the *ovary* or *germen*, containing the ovules or young seeds, and the *stigma*, a cellular secreting body, which is either seated immediately on the ovary (as in the tulip and poppy), and is then called *sessile*, or is borne on a stalk called a style, interposed between the ovary and stigma. The style is not necessary for the perfection of the pistil. Like the other organs of plants the pistil consists of one or more modified leaves, which, in this instance, are called *carpels*. When a pistil consists of a single carpel it is *simple;* when it consists of several, more or less united, it is *compound*. Each carpel has its own ovary, style (when present), and stigma, and is formed by a folded leaf, the upper surface of which is turned inwards towards the axis, and the lower outwards; while at its margins are developed one or more buds called ovules. The ovary always occupies the lower part of the pistil. It represents the limb or lamina of the leaf, and is composed of cellular tissue with fibro-vascular bundles and an epidermal covering. A transverse section of the ovary often shows a single internal cavity or *cell*, containing the ovules, in which case it is called *unilocular;* when there are two cells, it is called *bilocular;* when there are three, *trilocular;* when there are a great number, *multilocular*. The ovarian cells of some flowers contain only one ovule, others contain a great number. After flowering is over and fecundation has taken place, the cellular tissue enlarges and ripens the pulpy mass of the fruit, the epidermal covering becomes the rind, whilst each ovule is developed into a seed. The style and stigma either fall off, or remain and dry up, or increase in size, becoming feathery awns, beaks, &c. The style has usually a cylindrical form, and is traversed by a narrow canal, in which there are some loose projecting cells, forming what is called the conducting tissue, from the part which it plays in conveying the influence of the pollen to the ovules. The stigma is a continuation of the cellular tissue in the central part of the style, placed at the summit of the ovary or style, and destined to receive the influence of the fecundating substance from the anthers of the stamens. It is composed of cellular tissue more or less lax, and often having projecting cellules in the form of papillæ or of hairs, and at the period of fertilization exuding a viscous fluid, which retains the grains of pollen, and causes the protrusion of tubes. When situated at the summit of the style or ovary the stigma is said to be *terminal;* it is *lateral* when it occupies the sides of the style, or, when that part is wanting, of the ovary. See BOTANY.

PISTOIA (ancient, *Pistoria*), a town of Italy, in the province of Florence, and 20 miles north-west of the city of that name, with which it is connected by railway, near the left bank of the Ombrone. It is surrounded by lofty walls, has several large and handsome squares, spacious, well-paved, and well-formed streets; is the see of a bishop; contains a cathedral of ancient date, faced internally and paved with marble, and adorned with fine sculptures and paintings; the church Dell' Umiltà, with a magnificent dome; several other churches, a town-house, court-house, &c., and has manufactures of woollen and silk goods. Pistols were first made here. Pop. (1881), 12,224.

PISTOL, a small fire-arm with a curved stock, discharged with one hand, named from the town of Pistoia, where they were first made. Mention is made of their use in 1544. Being intended for fighting at close quarters, accuracy of aim was not attempted to be secured; in fact this would have been impracticable until the adoption of the fire-lock towards the end of the seventeenth century; and until well on in the present century, indeed, pistols were not generally provided with sights. The 'dag' mentioned by the Elizabethan writers was a kind of clumsy pistol. They were carried by the English cavalry as early as the reign of Henry VIII. Pistols are made of various sizes, ranging from 6 inches (the saloon and pocket pistol) to 18 and even 24 inches (the holster pistol). The mechanism of this arm resembles that of the musket (which see), and the process of manufacture is also similar. See REVOLVER.

PISTOLE, a gold coin met with in several parts of Europe, more especially in Spain, Italy, Switzerland, and some parts of Germany, but not now coined. It was originally a Spanish coin, and was equivalent to a quarter of a doubloon; the present Spanish pistol has a value of 16*s*. 2*d*.

PIT, in horticulture, the name applied to an excavation below the surface of the soil, intended to be covered by a glazed frame. In their simplest form, without any artificial heat, they are useful for protecting plants from the cold in winter; and even in summer this kind of pit affords a convenient means of sheltering delicate plants from heavy rains and a scorching sun. They may have turf, wood, or brick sides. When a strong heat has to be constantly maintained it may be kept up by fermenting matter, or by flues from a fire.

PITA HEMP, a name given to the fibre of the agave or American aloe. See ALOE.

PITAVAL, FRANÇOIS GAYOT DE, a French jurisconsult and miscellaneous writer, was born at Lyons

in 1673. He was successively abbé, soldier, lawyer, and man of letters. The most important and best known of his works is a collection of criminal trials —Causes Célèbres et Intéressantes (1734–43, twenty vols. 12mo), a work subsequently supplemented by La Ville (1769, four vols.) and by Richer (1772–88, twenty vols.).

PITCAIRN ISLAND, an island in the South Pacific, belonging to the Low Archipelago, lat. 25° 5′ s.; lon. 130° 5′ w.; length, 2¼ miles; breadth, about 1 mile. Its coast is almost perpendicular throughout its whole extent, and is, moreover, fringed with formidable rocks and reefs, making it impossible to land except at a very few points—one at the west end, and another on the north-east, called Bounty Bay. The last is that generally used, but even it becomes impracticable in strong winds. The island, rising to the height of 1100 feet, becomes visible at a distance of 50 miles, and when more nearly approached presents a somewhat wild but beautiful appearance. Its summits are clothed with luxuriant verdure, and the bases of its lofty cliffs are skirted with thickly-branching evergreens. But the interest which attaches to Pitcairn Island is derived far less from its physical than from its moral features. In 1790 nine British sailors, mutineers of the *Bounty*, landed on it, with eighteen natives of Tahiti, six men and twelve women. They found proof of former but no actual inhabitants, and might easily have managed, from the natural fertility of the soil, to subsist in tolerable comfort; but violent dissensions soon arose, and they commenced killing each other, and at the end of ten years the only survivors were John Adams, an Englishman (whose real name was said to have been Alexander Smith), the females, and nineteen children. Providentially among the articles which the mutineers had brought with them were a few Bibles and prayer-books; and Adams, partly by the perusal of them, was stung with remorse for his past life, and became a genuine Christian convert. He took upon himself the religious training of the little community, and with such remarkable success that probably since the first planting of the gospel its genuine fruits have never been produced more purely and abundantly than on this lonely islet of the Pacific. In 1808 Captain Folger, an American, touched at the island, and reported the state of matters to the British government. In the autumn of 1814 a British vessel called at the island, and found Adams still alive and commanding the respect and admiration of the little colony. Every successive visitor seemed to vie with those who preceded him in lauding the inhabitants for their numerous virtues, social and domestic. Their kindness and hospitality were of the purest and most unsophisticated description; every individual of suitable age could both read and write; drunkenness was entirely avoided; quarrels in the usual sense of the term were unknown; and when disputes did arise, they were either settled at once by a magistrate annually appointed by the votes of all the males and females above eighteen, or with the assistance of a jury, and in the rare case of continued misunderstanding, by the final decision of the captain of the first man-of-war that visited the island. The inhabitants were congregated in a village which was situated a little west of Bounty Bay, and consisted of well-built, clean, and comfortable dwelling-houses, and a large and substantial building used both as a chapel and school-room. In 1856 this interesting community, to the number of 194, was transferred to Norfolk Island, Pitcairn having become too small for their comfortable subsistence. Of this number about 40 soon returned to the island. In 1881, at the time of the visit of H.M.S. *Thetis*, the inhabitants were found to number ninety-six, living in the same simple and primitive manner. The men employ themselves in fishing, herding cattle, and in field labour; the women, besides attending to their domestic duties, greatly assist in cultivating the soil, which yields abundance of potatoes, yams, some maize, and many varieties of fine fruit—plantains, pine-apples, bread-fruit, oranges, melons, limes, &c. These are exchanged for wearing apparel and other necessaries, obtained from whaling and other vessels that occasionally touch at the island.

PITCH, the residuum which remains after boiling tar in an open iron pot, or in a still, till the volatile matter is driven off. It is made in Great Britain, but great quantities are imported from Russia, Norway, and North America. It is extensively used by ship-builders for caulking the seams and coating the outsides of ships and boats. An inferior kind of pitch is obtained by distilling coal-tar, and bone-tar gives an article almost equal in value to that got from wood. Much of the artificial asphalt used for building and paving purposes is made of coal-tar.

PITCH, the acuteness or gravity of any particular musical sound. A musical sound is produced by a series of atmospheric vibrations falling upon the ear at precisely equal intervals of time, and following each other so rapidly that no intermission can be perceived. The number of vibrations in a given time determines the pitch of the tone, the lower numbers giving the grave or deep tones, and the higher the acute or shrill tones. As all short and thin sonorous bodies vibrate more rapidly in a given time than larger and more massive bodies, it follows that in stringed instruments the pitch is dependent on the length, thickness, and degree of tension of the string, short, thin, and tightly-stretched strings giving the highest tones; and in wind-instruments, such as the flute or organ, the pitch is determined chiefly by the length of the column of air set in motion. (See MUSIC and ACOUSTICS.) Instruments are tuned by means of a tuning-fork, the two prongs of which are made of such a length that, when made to vibrate, a particular tone is produced. This note is generally the C in the third space of the treble clef, or A in the space below it, the latter being the note to which the second string of the violin is tuned. At the close of the seventeenth century the standard C tuning-fork made 489 vibrations per second; but in 1859 the opera pitch had risen so high as 546, which was too great a strain upon the soprano and tenor voices. A committee of the Society of Arts was that year appointed to consider the subject of a uniform musical pitch, to whom Sir John Herschel recommended the theoretical number of 512. This was objected to by instrument dealers and performers, as the instruments then in use could not be toned below 528 without altogether sacrificing brilliancy of tone. The latter number was then accepted by the committee as a compromise.

PITCHER PLANT. See NEPENTHES.

PITCH-STONE, a felspathic mineral containing excess of silica, and having a pitchy fracture. It is found chiefly in Southern Europe, South America, and Mexico.

PITH. See MEDULLA.

PITT, Earl of Chatham. See CHATHAM (WILLIAM PITT, EARL OF).

PITT, WILLIAM, second son of the Earl of Chatham, was born May 28, 1759. At the early age of seven he was remarkable for the interest he took in grave subjects, the ardour with which he pursued his studies, and the pithiness of his remarks. At fourteen he had all the intellect of a man, and wrote a tragedy not worse then many printed by persons of mature years. His physical development was not equal to his intellectual; he was tall, slender, and

sickly; port-wine was prescribed by the physicians, and he daily drank as much of this pleasant medicine as would have helplessly intoxicated many a full-grown man. He was educated at home instead of being, like most of his future colleagues, sent to one of the great public schools. At the age of fourteen he was entered of Pembroke Hall, Cambridge, where his knowledge of mathematics and the classics seems to have astonished ripe scholars. His acquaintance with modern literature was slight. Of living languages besides his own he was almost entirely ignorant; an imperfect knowledge of French was all he possessed. His favourite English authors were Shakspere, Milton, Locke, Adam Smith, and Bolingbroke. His father had trained him from infancy in the management of his voice, which was naturally clear and deep-toned; and his whole education had been directed to the end of making him a great parliamentary orator. In 1777 he entered Lincoln's Inn, and in 1780 was called to the bar. He attended the western circuit once or twice, when he was introduced into Parliament by Sir James Lowther, as representative for his borough of Appleby, at the age of twenty-one. His maiden speech was delivered in support of Burke's financial reform bill, and he also spoke in favour of a reform in Parliament. On the breaking up of the Rockingham administration he became chancellor of the exchequer at the age of twenty-three, under the premiership of the Earl of Shelburne. A general peace soon followed, which being made the ground of censure by a strong opposition, the cabinet was dissolved, and the Fox and North coalition took its place. On his retirement from office Pitt resumed his efforts for a reform in Parliament. His first motion was made on the 17th May, 1782, before a house of more than 300 members, and was only lost by twenty votes, the best division reformers succeeded in obtaining till 1832. On the failure of Fox's India Bill, which produced the dismissal of the coalition, Pitt, although at that time only in his twenty-fourth year, assumed the station of prime minister by accepting the united posts of first lord of the treasury and chancellor of the exchequer. Although strongly supported by the sovereign, he stood opposed to a large majority of the House of Commons, and a dissolution took place in March, 1786. At the general election which followed the voice of the nation appeared decidedly in his favour, and some of the strongest aristocratical interests in the country were defeated, Pitt himself being returned by the University of Cambridge. His first measure was the passing of his India Bill, establishing the board of control, which was followed by much of that fiscal and financial regulation that gave so much *éclat* to the early peroid of his administration. The establishment of the delusive scheme of a sinking fund followed in 1786. In 1788 Pitt resisted the doctrine of the opposition that the regency, during the king's indisposition, devolved upon the Prince of Wales by right. The minister maintained that it lay in the two remaining branches of the legislature to fill up the office, but that the prince could not be passed over in nominating to this post. By the adoption of this principle he was enabled to pass a bill restricting the regent's power, which the king's recovery rendered unnecessary. The French revolution now broke out, and in 1793 war arose between Great Britain and France. The details of the momentous contest which followed form no subject for the biographer. Great Britain was successful by sea; but during the life of Pitt the conflict on the Continent was in favour of France. The suspension of cash payments in 1797, the necessity of attending to home defence, the mutiny in the fleet, and the accumulation of the public burdens which still press so heavily on the nation, were some of the bitter fruits of this struggle. In 1800 the Irish union was accomplished. In 1801 the opposition of the king to all further concession to the Irish Catholics (see CATHOLIC EMANCIPATION) caused him to resign his post. The Peace of Amiens succeeded; and the Addington administration, which concluded it, Pitt supported for a time, and then joined the opposition. The new minister, who had renewed the war, unable to maintain his ground, resigned; and in 1804 Pitt resumed his post at the treasury. Returning to power as a war minister, he exerted all the energy of his character to render the contest successful, and found means to engage the two great military powers of Russia and Austria in a new coalition, which was dissolved by the battle of Austerlitz. Pitt, whose state of health was previously declining, was sensibly affected by this event; and his constitution, weakened by a hereditary gout, and injured by a too liberal use of wine by way of stimulant, rapidly yielded to the joint attack of disease and anxiety. The parliamentary attack upon his old associate, Lord Melville (see DUNDAS), not wholly parried either by ministerial influence or the merits of the case, is thought to have deeply wounded his feelings, and completed his mental depression. A state of extreme debility ensued, which terminated in death, encountered with great calmness and resignation, January 23, 1806.

It is generally conceded that the genius of Pitt was better adapted to the regulative process of peaceable and domestic government than to the arrangement and conduct of those warlike operations which his policy entailed upon the country. At the same time it must be confessed that he had to encounter overwhelming energies—the result of a social crisis of most extraordinary character. If, therefore, he can be acquitted of a want of foresight in volunteering such a conflict, the result of the warfare, in establishing French ascendency on the Continent, may be regarded as the effect of causes which no abilities could have controlled. To some extent he was, perhaps, more the man of expediency than of principle. In the outset of his career he was a warm advocate of parliamentary reform, but he soon abandoned the cause. He spoke and voted in favour of the abolition of the slave-trade; but although supported by the voice of a decided national majority, he would not make a ministerial measure of it, as was done without difficulty by his immediate successor; nor can we trace any decided social amelioration to his influence. As a financier he was expert in practice rather than scientifically grounded; while the waste and profusion of his warlike expenditure were extreme, and will long be felt in their consequences. Love of power was his ruling passion, and he was altogether above the meanness of avarice, his personal disinterestedness being extreme. His eloquence, if not more elevated or profound, was, upon the whole, more correct than that of any other orator of his time, and his language was remarkably copious and well arranged. Although neither illuminated by the flashes of genius which characterized his father's oratory, nor by the imagination which distinguished the eloquence of Burke, it was more uniformly just and impressive than that of either; while the indignant severity and keenness of his sarcasm were unequalled. On the whole Pitt was a minister of commanding powers, and he died in possession of the esteem of a large portion of his countrymen. A public funeral was decreed to his honour by Parliament, and a grant of £40,000 to pay his debts. See Lord Stanhope's Life of Pitt (London, 1861).

PITTACUS, one of the so-called seven wise men of Greece, born about B.C. 652 at Mitylene, on the island of Lesbos. He was highly celebrated as a

warrior, a statesman, a philosopher, and a poet. In 589 the citizens raised him to the dictatorship, an office which he sagaciously filled for ten years, when he voluntarily resigned it. After other ten years spent in honoured retirement he died at an advanced age in 569. Many of the stories told about Pittacus, all of which tend to show his contented and unostentatious disposition, are doubtless apocryphal. It is said that he refused a number of costly presents from Crœsus, with the remark that he had already twice as much wealth as he used. Two of the maxims ascribed to him are 'know the fitting moment,' and 'it is a misfortune to be eminent.' Of his 600 didactic verses only four have been preserved; the genuineness of his letter to Crœsus, still extant, is doubted by many authorities.

PITTSBURG, a city of the United States, in Pennsylvania, in Alleghany county, 223 miles north-west of Washington, advantageously situated at the central point of the large and valuable coal-fields of Western Pennsylvania, in the angle traced by the Monongahela and the Alleghany in uniting to form the Ohio. It is situated on the great Pennsylvania trunk lines of railway from the east to the west, and is connected by branch lines with three other trunk lines of the country. Great transportation facilities result from the concentration of eleven different railway lines, and the union of the three rivers at whose junction it is situated. The site is naturally rich in picturesque beauty; but its attractions in this respect are much destroyed by the sulphureous vapours and dense clouds of smoke which are continually rising from the bituminous coal used in the numerous factories, and give the whole place a dingy appearance. Pittsburg consists of the town proper and of several large suburbs, with which, when on the opposite side of the rivers, the connection is kept up by twelve bridges comprising some of the finest specimens of iron suspension-bridge architecture ever constructed. Pittsburg is irregularly triangular in form, and has in a great measure been laid out in separate systems of streets corresponding to the divergence of the rivers and the form of the hills over which it extends. Many of the streets have a respectable and even handsome appearance, while the suburban residences are surrounded by ample and attractive grounds. Of the adjacent places which, though separately incorporated, are properly regarded as only suburbs of Pittsburg, the most important are Alleghany on the right bank of the Alleghany river, and Braddocks on the right bank of the Monongahela to the east of the city. Alleghany vies with Pittsburg in its public edifices, and surpasses it in the elegance of its private mansions, which, often occupying airy and commanding positions, have been selected for residence by the wealthier citizens. Among the public edifices in the town proper there are over 100 churches, none of them having great architectural merit except the Roman Catholic Cathedral, the Trinity Episcopalian Church, the German Lutheran, and the First and Third Presbyterian Churches. The finest buildings are the court-house, consisting of a handsome Gothic structure with a tower; the new United States court and post-office buildings, both under construction in 1884. Other buildings or objects of note are the banks and hotels, the city halls, three large hospitals, four denominational seminaries (Catholic and Protestant), and the state penitentiary in Alleghany.

Pittsburg has almost inexhaustible sources of prosperity both in its manufactures and its trade. Its coal-seams, situated generally above the level of the rivers and torrents, are easily worked by means of adits, without deep sinkings or expensive drainage; while its rivers and railways bring it into immediate communication with the great commercial emporiums of the east, west, and south. Its industrial establishments include numerous rolling-mills, foundries, glass-works, breweries, &c. In addition to these are extensive factories in which articles in iron and steel are produced, white-lead and soda-ash works, copper-smelting furnaces, copper rolling-mills, &c. In each of the staples of iron, steel, and glass it is the principal producing centre of America; and the total of coal and coke produced by its capitalists in West Pennsylvania is also larger than that of any other city in the union. The chief articles of export are petroleum, coals, iron, ironmongery, leather, tobacco, malt liquors, &c. Pittsburg occupies the site of a fort called Du Quesne, which was built by the French in 1754, and was used by them as a central point from which, in conjunction with the Indians, they spread terror among the frontier settlements of Pennsylvania. In an attack on this fort in 1755 the British were defeated, with the loss of their commander, General Braddock. The fort was captured by the British under the leadership of Washington in 1758, and named after William Pitt. For some time Pittsburg made little progress, and in 1775 did not contain more than thirty dwellings within its present city limits. Its first great start was made in 1811, on the introduction of steam navigation; but it can hardly be said to have entered on its full career of prosperity till the opening of its rich field of coal and iron. It was chartered in 1816, and was nearly destroyed by fire in 1845. Its population in 1870 was 86,076; by the census of 1880 it was 156,389, not including Alleghany and other suburbs, which would bring it up to over 250,000.

PITTSFIELD, a flourishing city of the United States, Massachusetts, in Berkshire county, on the frontiers of New York, about 151 miles west of Boston by rail, in a wide valley between the Taconic and Green Mountains, at the confluence of the Pontoosuc and Housatonic. It is well built, and near its centre is a square with an area of about 4 acres. Pittsfield contains the Berkshire Medical Institution, which, as a medical school, enjoys a high reputation, and occupies a handsome and commodious range of buildings. The manufactures are very extensive, and include cotton and woollen goods, silk, castings, machinery, tools, paper, boots and shoes, brewery products, &c. The salubrious climate of Pittsfield, its easy access, and beautiful scenery make it a desirable residence, and attract great numbers of summer visitors. Pop. (1880), 13,364.

PITYRIASIS, a chronic, non-contagious, superficial affection of the skin, attended by the production of minute white scales, frequently on patches of irregular form, and of a light or dull red colour. It may occur on any part of the body (rarely over the general surface), and gives rise to itching, tingling, or pricking sensations. The scales are thrown off as soon as they are produced, and are renewed as fast as they are lost. It occurs most frequently on the scalp, when it is popularly known as dandriff. The itching attending the irruption is often annoying, causing the patient to scratch the part and loosen showers of scurf, which fall on the clothes in the form of a white mealy powder. Slight cases are easily cured by the frequent use of the warm bath, but should they prove obstinate the hair must be cut as short as possible, and the scales softened by poultices and the vapour-bath, the latter being continued for some time and alternated with alkaline or emollient lotions. At the same time the bowels should be freely evacuated, the abdominal secretions and excretions duly promoted, and the cutaneous exhalations increased by means of purgatives, alteratives, and cooling diaphoretics. The stomach should never be overloaded, and animal food sparingly partaken of.

PIU, an Italian word signifying more, and used in musical scores to intensify another adverb, as *più presto*, more quickly, *più piano*, more softly, *più tosto allegro*, rather more briskly.

PIUS II., originally called ÆNEAS SYLVIUS PICCOLOMINI, was descended from one of the most illustrious Tuscan families, and was born in 1405 at Corsignano, in the Duchy of Siena. In 1428 he was sent to the University of Siena, where he applied himself with ardour to the study of belles-lettres, and published several Latin and Italian poems, which met with great applause. He afterwards diligently studied civil law, and in 1431 his learning and accomplishments recommended him to Cardinal Capranica, whom he accompanied to the Council of Basel in the capacity of secretary. He soon gained the confidence of the fathers by the zeal with which he espoused their cause against Pope Eugenius IV., and the many learned speeches which he made to prove the superiority of general councils over the bishops of Rome. He was therefore made secretary to the council, and was subsequently employed on various missions of great importance. On the election of the anti-pope Felix V. by the Council of Basel Piccolomini was made Papal secretary, but having been sent on an embassy to Frederick III. of Germany he was induced to take office in the imperial court. When the emperor embraced a neutrality between the Council of Basel and Eugenius, Piccolomini, notwithstanding the active part he had taken among the fathers, followed his master's example, and was afterwards chosen as the imperial ambassador in a diet at Ratisbon, where the means of putting an end to the schism in the church were taken into consideration. At length he was sent by Frederick, about the end of 1446, to negotiate the submission of Germany to Eugenius, and availed himself of this opportunity to condemn his own past conduct and to implore the forgiveness and favour of his holiness. This request Eugenius readily complied with. By the succeeding pope, Nicholas V., Piccolomini was made Bishop of Trieste, and in 1456 was raised to the cardinalate by Calixtus III. Upon the death of this pontiff Æneas was unanimously elected to fill the Papal chair, and at his coronation he assumed the name of Pius II. One of the first measures of his government was an attempt to unite the Christian princes to drive the Turks out of Europe, but the scheme fell to the ground. In 1460 he published a bull condemning the doctrine he had in former years so vigorously defended—the superiority of a general council to the pope—and forbidding all appeals to such councils under the severest penalties. He died 14th August, 1464. Pius II. was one of the most learned men of his age, and left behind him several historical works and dissertations of considerable value, together with a collection of extremely interesting letters, characteristic both of the writer and his age.

PIUS IV. (GIOVANNI ANGELO MEDICI) was born at Milan in 1499. He went to Rome in early life, and rapidly rose into the favour of the successive popes Clement VII., Paul III. (who made him a cardinal), Julius III., and Paul IV., whom he succeeded in 1559. One of the first acts of his pontificate was the execution of the Caraffas, brother and nephews of his predecessor, for their insolence, rapacity, and notorious crimes. Under his government the deliberations of the Council of Trent were brought to a close, and the duty devolved upon him of issuing in 1563 a bull confirmatory of its decrees. The Tridentine Creed, sometimes known as that of Pius IV., was issued by him as an embodiment of all the doctrines defined in the Council of Trent. He died in 1565. He was succeeded by Pius V.

PIUS V. (MICHELE GIUSLIERI) was born of obscure parents in 1504 at Bosco, a small town near Alessandria. At the age of fourteen he entered the Dominican convent at Voghera. He was raised to the cardinalate by Paul IV. in 1557, and about the same time was appointed inquisitor in Lombardy. He subsequently became inquisitor general—an office which he exercised with rigour against the Reformation. On the death of Pius IV. in 1565 he was chosen to succeed him, and immediately set about effecting reforms both in morals and discipline. He excited terror in Italy by the seizures, imprisonment, and burning of those convicted or suspected of heresy, among whom were several persons of note. In 1568 he sent a large body of troops to assist Charles IX. of France in his war against his Protestant subjects; and the same year renewed the bull In Cœna Domini (which see). He enforced the authority of the Index Expurgatorius, and expelled the Jews from all parts of the Papal States excepting the cities of Rome and Ancona. In 1570 he excommunicated Elizabeth of England. He lent his influence and assistance to the Venetians and the Spaniards in their war against the Turks, which ended in the memorable victory of Lepanto (September, 1571). He died on the 1st of May, 1572. He was canonized by Clement XI. on 24th May, 1712.

PIUS VI., whose secular name was GIOVANNI ANGELO BRASCHI, was born at Cesena, in 1717. He was appointed secretary to Benedict XIV., filled several important offices under Clement XIII., and was raised to the cardinalate by Clement XIV. On the death of that pontiff, in 1775, he succeeded to the Papal throne, and shortly after made a reformation in the financial department, and also improved the museum of the Vatican. But the greatest of his undertakings were the draining of the Pontine Marshes, the improvement of the port of Ancona, and the embellishment of Rome. While, however, this pontiff was successful in his domestic administration, he had the mortification to witness the absolute decay of the temporal power of the holy see, largely the result of the French revolution. In 1791 he lost Avignon and the county of Venaissin, which were reunited to France. In the first coalition against France the pope ranged himself among the enemies of the republic. In January, 1793, Basseville, the French secretary of legation, was massacred during a popular commotion at Rome; accordingly, after the victories of Bonaparte in Italy, in 1796, General Augereau marched into the territories of the pope, who, unable to resist, was glad to accept an armistice, which was signed at Bologna, June 13th. The pope having renewed hostilities, Bonaparte attacked and beat his troops at Senio, February 2, 1797, and proceeded towards Rome. He stopped, however, to treat with ministers sent by his holiness, and February 19 was signed the Treaty of Tolentino, by which the pope lost Romagna, Bologna, and Ferrara. December 28, 1797, in consequence of another commotion, in which General Duphot was killed, Joseph Bonaparte, the French ambassador, quitted Rome. An army, commanded by General Berthier, entered that capital February 10, 1798, and on the 15th proclaimed the establishment of the Roman Republic, governed by consuls, a senate, and a tribunate. The pope, after this deprivation of his authority, was conveyed to France as a prisoner, and died at Valence, August 29, 1799. In 1802 his body was removed to Rome, and solemnly interred.

PIUS VII. (GREGORIO BARNABA CHIARAMONTI) was born at Cesena in 1742, and at the age of sixteen was received into the order of Benedictines. After serving as teacher in several abbeys he became professor of philosophy in Parma, and subsequently

of theology in Rome, where his fellow-townsman, Pius VI., created him Bishop of Tivoli, and in 1785 cardinal and Bishop of Imola. By the Peace of Tolentino he became a citizen of the Cisalpine Republic, and displayed an inclination to republican principles. It appears to have been under French influence that he was chosen to fill the Papal chair, March 14, 1800, after which his notions underwent a total change. His domestic administration was conducted with a rigorous economy and a wise policy in the encouragement of commerce and manufactures. In 1801 he concluded a concordat with France; in 1804 revived the order of Jesuits in Sicily, but was obliged to consent to the sale of the church lands by the Spanish court. Pius, desirous of saving the wreck of the Papal power, complied with the invitation of Napoleon to be present at the coronation; but he was treated with little respect, either by the Parisians or by the emperor, who crowned himself and the empress with his own hands. The pope, finding that he was to expect no favours, refused to appear at the coronation in Milan, and was received by his subjects on his return (April 4, 1805) with loud expressions of dissatisfaction. The reforms of Joseph in Naples, and the secularizations in Germany, were new sources of mortification, and having offended Napoleon by refusing to recognize his brother Joseph as king of Naples, and to shut his ports against English ships, he was obliged to witness the occupation of Rome by French troops (February 2, 1808). The Papal cities were incorporated with the Kingdom of Italy, and the firm resistance of Pius to these aggressions, and his threat of excommunicating the emperor, could not prevent Rome from sharing the same fate (May 17, 1809). June 10 and 11 the pope issued two bulls of excommunication against all violators of the Papal territory. July 6 he was arrested in his chamber by French troops, and on refusing to renounce all claims to temporal power, conducted to Florence, and thence to Savona. In his confinement he rejected with firmness the offers of Napoleon, and refused to confirm the bishops appointed by the latter. In 1812 he was removed to Fontainebleau, where Napoleon obliged him to accede to a new convention (January 23, 1813), by which he promised to confirm the bishops; but the emperor having, contrary to agreement, proclaimed the concordat before its completion, and issued with it a code of organic laws, seriously affecting the discipline of the church on marriage, the clergy, and public worship, Pius, whose consent had been entirely conditional, refused to concur in any concordat that should not settle all disputed points. He was therefore treated as a prisoner, and it is said that he was personally abused by Napoleon. In 1814 the pope was released and restored to the possession of all the Papal territories except Avignon and Venaissin in France, and a narrow strip of land beyond the Po. Although attached to the old hierarchal policy, as appears from his bulls and briefs against the distribution of the Bible, against Catholic Switzerland, &c., yet none of his plans for restoring the old state of things, except the revival of the Jesuits, August 7, 1814, were successful. The concordats with France, Bavaria, and the Two Sicilies, and the convention with Prussia, were, however, triumphs of the policy of the Roman court. His administration, which was moderate and wise, was much indebted for its character to Cardinal Consalvi, his intimate friend and minister. He repressed with a vigorous hand the brigandage and disorder which the protracted wars had introduced, and broke up many of the secret societies which then existed, especially the Carbonari. Rome became again not only the refuge of fallen princes and proscribed families, but the seat of the fine arts. Pius VII. died in consequence of a fall, July 6, 1823, and was succeeded by Leo XII. In his tastes he was simple; in disposition, devout, benevolent, and mild.

PIUS VIII. (Francisco Xaviero Castiglione) was born at Cingolia, a small town in the States of the Church, in 1759, of poor but respectable parents. He was early distinguished for his industry, talents, and learning, and having entered the church young, passed through all the orders of the hierarchy, having been created cardinal by Pius VII., and March 31, 1829, unanimously elected pope by the conclave of cardinals, on the death of Leo XII. Pius VIII. died 30th November, 1830, and was succeeded by Gregory XVI.

PIZARRO, Francisco, the name of a celebrated Spanish adventurer, the discoverer and conqueror of Peru. His origin and early habits were sufficiently humble, he being the fruit of an illicit connection between a peasant girl and a hidalgo of Truxillo, in Estremadura, in the neighbourhood of which place he first saw the light about 1475. Receiving neither support nor countenance from his father, he was thrown entirely upon his mother's resources, who employed him as a swineherd, and left him totally illiterate. The spirit of adventure which at that period pervaded Spain induced him at length to quit his inglorious occupation, and in company with some other soldiers of fortune to seek an improvement of his condition in the newly found continent of America. He was in Hispaniola in 1510, and afterwards was connected with Balboa when the latter discovered the Pacific. After Balboa's death he attached himself to the governor Pedro Arias, and was engaged in several military expeditions. In 1515 he was one of a small company who were sent across the isthmus of Darien to trade with the natives of the Pacific coast. He established himself near Panama, when it became the capital of the Spanish dominions in this quarter, and cultivated a piece of land by the labour of slaves. Subsequently he became associated with Hernando Luque, or de Luques, a priest possessed of some money, and Diego de Almagro, an adventurer like himself, and having jointly fitted out an expedition the associates set sail from Panama on a voyage of exploration and conquest along the coast to the southward (1524). Their first voyage was unsuccessful, but they learned the existence of the rich empire of Peru, and were not long in making a second voyage, with the intention of conquering this country. Their forces were too few, however, for this object, and Pizarro determined to seek assistance in Spain. He reached Seville in 1528. He was received at court with distinguished favour, and obtained a commission bestowing on him the right of discovery and conquest in Peru, with the rank and title of governor and captain-general of the province. Raising a small force in Spain, he recrossed the Atlantic (in 1530), and next year sailed from Panama at the head of a small force. Taking advantage of a civil war then raging in that country, the Spaniards became the allies, and eventually the enslavers of Atahualpa, or Atabalipa, as he is variously called, the reigning inca. Treacherously seizing upon the person of the monarch at a friendly banquet to which they had invited him and his whole court, they first compelled him to purchase, at an enormous price, a temporary reprieve from a death which they had determined he should eventually undergo; and having succeeded in extorting from him, it is said, a house full of the precious metals by way of ransom, after a mock trial for a pretended conspiracy, condemned him to be burned, allowing him to be first strangled, as a reward for becoming a Christian. The news of their success brought a considerable accession of

strength from Europe to the invaders; and Pizarro, in order to consolidate his empire, founded, in 1535, the city of Lima, which he intended as the capital of his possessions; but the discord which had long existed between Almagro and Pizarro at last broke out into open violence, and in the struggle which ensued Almagro, now in his seventy-fifth year, was defeated, taken prisoner, and strangled, by Hernando Pizarro, brother to the general. This catastrophe, which took place in 1537, was avenged four years afterwards by the son of the victim, and bearing the same name, who having organized a conspiracy against the destroyers of his father, broke into the palace at Lima, and after an obstinate resistance succeeded in despatching Francisco Pizarro, 26th June, 1541. It is impossible to refuse to this adventurer the credit of considerable military as well as political talent, though the one was sullied by his extreme barbarity, the other by his perfidy and heartless dissimulation.

PIZARRO, GONZALO, brother of the preceding by the same father, but another mother, and also illegitimate, was born at Truxillo in 1502. He accompanied his brother on his second visit to Peru in 1531. In early life he had signally distinguished himself as a soldier, and when he reached the New World he was acknowledged to be the best lance in Peru. His talents were exclusively those of a guerilla chief, as he wanted the military and civil capacity of his elder brother. In 1540 he was appointed by Francisco governor of Quito, and he was directed to undertake an expedition towards the east, where a land supposed to be extremely rich in spices was reported to lie. At the head of 350 Spaniards and 4000 Indian auxiliaries he set out on the expedition across the Andes, which resulted in the discovery of the head-waters of the Amazon, and the descent of that stream to the ocean by Francisco de Orellano, one of his officers. The expedition occupied two years, and so thinned the ranks of the adventurers by its hardships that only eighty Spaniards and the half of the Indians returned to Quito. After the assassination of Francisco, Gonzalo raised an army and advanced upon Lima to attack Blasco Nuñez, the new and unpopular viceroy sent out from Spain. He was warmly supported by the bulk of the colonists, and many of the royal troops. On the 18th January, 1546, a battle took place near Quito, in which Nuñez was defeated and slain. But in the following year Pizarro was attacked by an army under Pedro de la Gasca, who had been sent from Spain, invested with the powers of the sovereign. After several encounters Pizarro was deserted by many of his followers, and was eventually defeated, taken prisoner, and beheaded (1548).

PIZZICATO (Italian, contracted *pizz.*), an expression frequently met with in music for instruments of the violin kind, signifying that the notes over which it is placed are not to be played by the bow, but by twitching the strings with the fingers. A return to the ordinary mode of playing with the bow is marked by the words *col arco*, often contracted *c. a.* The pizzicato is often employed in accompaniments, and has a piquant guitar-like effect; fine examples of this are the accompaniments to the romance sung by Cherubino in the Nozze di Figaro and in the serenade in Don Giovanni. On the violoncello pizzicato passages have a grave, melancholy, and even pathetic effect, and are occasionally met with in the symphonies of Beethoven and the operas of Meyerbeer.

PLACE, LA. See LAPLACE.

PLACENTA, or 'AFTER-BIRTH,' the structure which, in the higher Mammalia, connects the fœtus, or unborn embryo, with the circulation of the mother, and thus provides for its due nutrition, and for its respiration also. Although the placenta, as such, and in its most typical form, is only met with in the development of the higher Mammalia, certain analogous structures appear to exist in connection with the development of the young of some species of Sharks and Dog-fishes. Thus in connection with the embryos of *Mustelus* and *Carcharias* (belonging to the order Elasmobranchii) a rudimentary placenta is developed by the walls of the umbilical vesicle becoming folded or plaited, and by these folds interlacing and uniting with others developed from the wall of the *uterine* cavities. The *uteri*, or wombs, in these fishes are formed by the dilated ends of the oviducts; and the uterine cavities open into the *cloaca*, or chamber common to the terminations of the digestive, urinary, and generative systems. These fishes, however, it is to be noted, not only in their developmental history, but also in their structural relations, differ widely from the other orders of their class. The placenta of these fishes also differs from the true placenta of Mammalia in being developed from the *umbilical vesicle*, and not, as will presently be explained, from the *allantois* and *chorion*, as in the majority of Mammalia. The lower Mammalia are termed *implacental* or *aplacental*, from their wanting a placenta, and in contradistinction to the higher or *placental* mammals. These lower mammals include two orders only—those of the Monotremata (represented by the Ornithorhynchus and Echidna), and the Marsupialia (represented by Kangaroos, Opossums, &c.) All other mammals, included under the name of Monodelphia, therefore, possess a placenta, although in one or two cases (for example, Sirenia, Dugongs, and Manatees) the particular *form* of the placentation has not as yet been ascertained.

Differences exist in the mode of development and attachments of the placenta in the different orders of Mammalia. It will tend to the clearer understanding of the subject if the human placenta, as presenting us with the most perfect type of that structure, be first considered. After impregnation and gestation have been fulfilled and inaugurated the upper or superficial layer of the mucous or lining membrane of the human womb grows thicker, becomes more vascular, and thus forms the membrane known as the *decidua*. As development proceeds, and at a very early stage in its history, the decidua exhibits a threefold division. The layer immediately lining the uterine cavity is termed the *decidua vera*, this name being given to it by Dr. W. Hunter; the second layer, or that directly investing the embryo or ovum, is named the *decidua reflexa;* whilst a third layer, named the *decidua serotina*, is developed towards the base or lower portion of the decidua reflexa. This third layer is to be regarded as a special growth of part of the decidua vera, and it is developed in especial connection with certain processes, or *villi*, which are developed from the *chorion*. The *chorion* is the covering which directly invests the egg or embryo itself. The decidua reflexa is also to be considered as developed from the decidua vera, and as a general outgrowth of that membrane.

The villi of the chorion are at first loosely and superficially imbedded in the decidua serotina; but ultimately they disappear from every other portion of the chorionic surface, and become greatly and especially developed at the point of attachment of the ovum to the decidua. The embryo becomes thus fixed and attached to the uterine walls; and as development proceeds blood-vessels appear within the villi, these vessels being formed from the inner layer of the chorion or *endochorion*, as it has been termed. These blood-vessels, by their gradual enlargement and interlacing with each other, together with the increase of the contiguous decidua, form the mass or bulk of the future placenta. The

mucous membrane of the womb itself, in the neighbourhood and at the site of the placental development, is meanwhile being traversed in its deeper layer by blood-vessels, consisting of arteries and veins, which carry blood to and return it from the placenta. Then also the decidua next the uterus and furthest from the chorion and ovum become excavated or cellular in structure, and show numerous spaces, termed *sinuses*, into which the arteries and veins of the uterine membrane open. The villi of the chorion penetrate into these sinuses, the wall of the sinus being pushed before the villi. In this manner the villi and the blood of the uterine arteries and veins contained in the sinuses are brought into contact. This, at least, is one view of the mode in which the blood-vessels of the mother are brought into relation with those of the fœtus or embryo—the question whether *direct* vascular communication between the placenta and uterus exists being one of much interest, and which has been variously debated by physiologists. Flourens and others believed that the blood-vessels of the mother and those of the placenta communicated with each other, and that thus the fœtus was nourished directly by the pure blood of the parent. By the Hunters and Monros, by Wrisberg and other physiologists, this continuity of the vascular systems was denied. The umbilical arteries which were formerly thought to end in the vessels of the uterus were shown by them to terminate in the umbilical veins. They believed that the maternal blood was conveyed through the so-called 'curling arteries' of the uterus into cellular tissue, and gained access to the embryo through the thin walls of the umbilical vessels distributed to the placenta. John Reid believed with the Hunters in the existence of placento-uterine vessels, and that the maternal and fœtal systems were in communication indirectly—the maternal blood being sent into the decidual membrane and sinuses, and the placental tufts dipping into these uterine sinuses. This view, corresponding with that first stated, is the opinion mostly adhered to by the physiologists of the present day, and it is important to note these opinions in relation to the structure and functions of the placenta.

The fully-formed human placenta consists, therefore, of a fœtal or embryonic part, and of a maternal portion, the former consisting of structures developed by the embryo, the latter of structures formed from the tissues of the mother. At the end of pregnancy it attains a thickness of about 1 or 1½ inch, its diameter being 6 or 8 inches, and its circumference 18 to 24. In man it is therefore of a rounded or 'discoidal' shape, and more rarely bilobular or multilobular in general form. Its internal surface is smooth and covered by the amnion and chorion, and beneath these membranes the umbilical vessels may readily be traced. The chorion is directly attached to the internal surface of the placenta, and processes of this membrane dip down between the lobes and lobules into which its substance is divided. The amnion is more loosely attached over the chorion. The outer or uterine surface of the placenta, or that by which it is attached to the walls of the uterus, is somewhat roughened and covered by the decidua serotina. It is uniform and level, and the lobes or divisions of the placenta are more plainly visible when the decidua serotina is stripped off. Processes of the decidua dip down between the lobes on this surface, as the chorion did on the inner surface. The vessels forming the lobes of the structure do not appear to anastomose or unite with those of neighbouring lobes.

At birth, or rather during the process of parturition, the decidua serotina splits or ruptures along the layer which has been already described as being cellular in structure. The upper part of this membrane; the amnion and chorion, constituting the fœtal membranes; the rest of the decidua (vera and reflexa); and the umbilical cord are then cast off; the connection between the wall of the uterus and these placental structures being severed by the uterine contractions, the placenta being thrown off as the '*after*-birth,' after the child itself has been expelled. The deeper layer of the decidua serotina, however, is retained for a longer or shorter period, but appears gradually to be discharged from the womb with the usual (*lochial*) discharge which follows parturition—this decidua undergoing fatty degeneration. Whilst the new mucous or lining membrane of the uterus, which has been developing during pregnancy, assumes the place of the cast-off decidua, and attains its perfect structure by having that portion of its surface which was occupied by the placenta gradually formed and completed.

Such is a brief *resumé* of the formation and functional development of the placenta in man. This structure in man, from its maternal portion being cast off at birth, is called *caducous* or *deciduate;* or, from the degree of union formed between the maternal and fœtal parts, it is termed a *coherent* placenta. In the Pig and in other groups of Mammalia, to be presently noted, the placental structure differs in important respects from its type in man. In these lower forms no decidual membranes exist, the lining membrane of the uterus merely exhibiting a greater vascularity, but without developing into distinct decidual layers. The chorionic villi of the embryo attach themselves directly to the lining membrane of the uterus, and the villi are further developed uniformly and universally over the surface of the chorion—save at the poles—and are not restricted to one portion, as in man. At birth, in this latter case, therefore, no maternal parts or structures of the mother are cast off, the villi of the fœtal membranes being simply withdrawn from the fossæ or depressions in the uterine walls. The placenta in the latter case is therefore said to be *non-deciduate*, or *non-caducous*, or *incoherent*, in opposition to the characters seen in the placentation of man.

On surveying the higher Mammalia variations in the mere *form* of the placenta may be discerned as resulting from deviations in structural development. The Quadrumana, Bats, Insectivora, and Rodents possess, like man, a cake-like or 'discoidal' placenta. In Carnivora the placenta encircles the embryo like a zone or belt, and is hence termed 'zonary.' In Ruminants the placenta consists of detached lobes or *cotyledons*, each consisting of a group of vascular chorionic villi, which are either convex, and are received into cups on the uterine surface (as in the Sheep); or concave, and fit convexities of the uterus (as in the Cow). In the Pig, Horse, Camel, &c., and in Cetacea, the villi of the chorion present a scattered disposition, the placenta in such a case being termed 'diffuse.'

The orders Bimana (Man), Quadrumana (Apes, &c.), Insectivora (Shrews, Hedgehogs, &c.), Cheiroptera (Bats), and Rodentia (Rats, Mice, Hares, Porcupines, &c.) possess a deciduate discoidal placenta. The Carnivora (Lions, Dogs, &c.), Proboscidea (Elephants), Hyracoidea (Hyrax) possess a deciduate zonary placenta. The Ungulata, or Hoofed Quadrupeds (Horse, Rhinoceros, Tapir, Hippopotamus, Pig, Ruminants, &c.) possess a non-deciduate placenta, which is either 'diffuse' or 'cotyledonary.' The Cetacea possess a placenta agreeing in structure with that of the Ungulata. The placentation of the Sirenia (Dugongs and Manatees) is unknown; analogy, however, would lead us to conclude that the placenta of these forms agrees in form and structure with that of the Cetacea. In the order Edentata, represented by Sloths, Armadillos, Ant-eaters, Pan-

golins, &c., the placentation varies, it being found sometimes (as in Manis) to be diffuse and non-deciduate; in the Sloths, to be cotyledonous (non-deciduate?); and in Orycteropus or the Cape Ant-eater, to be deciduate and discoidal. (In a recent memoir by Professor Turner of Edinburgh, published in the Transactions of the Royal Society of Edinburgh, vol. xxvii., the placentation of the Two-toed Sloth (*Cholœpus Hoffmanni*) is shown to approach closely to that of man and those deciduate mammals possessing a discoidal placenta. The placenta is therefore discoid in shape, and maternal structures are thrown off at birth along with the fœtal membranes.)

The *functions* of the more perfect placenta, or its analogues in lower forms, are clearly those of establishing a communication between the blood or vascular systems of the mother and the embryo, with a view to the due nutrition of the latter. It is this connection, in its relation to the longer period of gestation in viviparous animals, which gives to such forms their high reproductive characters. A continual inflow of maternal and of fœtal blood is continually taking place in the placental structures; the streams, however, remaining distinct and separate, although through the thin membranous walls of the blood-vessels separating the two currents an interchange of materials is perfectly established. New and fresh nutritive matter is thus conveyed to the fœtus, whilst the effete products of the embryo are in turn excreted through the maternal system.

PLACENTA, in botany, a development of cellular tissue formed at some point of the inner side of a carpel, to which the ovules are attached either immediately or by umbilical cords. The part of the carpel where the placenta is formed is the inner or ventral suture, corresponding to the margin of the folded carpellary leaf; while the outer or dorsal suture corresponds to the midrib of the carpellary leaf; the placenta is hence sometimes called marginal. The placenta is formed on each margin of the carpel, and is therefore essentially double. When the pistil is formed by one carpel the inner margins unite in the axis, and usually form a common placenta, which may extend along the whole margin of the ovary as far as the base of the style, or it may be confined to the base or apex only. When the pistil is apocarpous (that is, composed of several separate carpels) there are generally separate placentas at each of their margins. In a syncarpous pistil, on the other hand, the carpels are so united that the edges of each of the contiguous ones by their union form a *septum* or *dissepiment*, and the number of these septa consequently indicates the number of carpels in the compound pistil. When the dissepiments extend to the centre or axis the ovary is divided into cells or loculaments, and may be bilocular, trilocular, or multilocular, according as it is formed by two, three, or many carpels, each corresponding to a single cell. In these cases the marginal placentas meet in the axis, and unite so as to form a single central one. Some call this placentation *axile*, but this term is perhaps properly restricted to cases where the placenta is an actual prolongation of the axis. When the carpels in a syncarpous pistil do not fold inwards completely so as to meet in the centre, but only partially, so that the dissepiments appear as projections on the walls of the ovary, then the ovary is unilocular, and the placentas are *parietal*. This distinction of axile and parietal is of great importance, as characterizing different natural orders.

PLACET, or PLACETUM REGIUM, the right belonging to the governing body of a state to be informed of all important ecclesiastical regulations and alterations, and give their sanction thereto, or withhold it if the interests of the state demand it. In European history we find this right most frequently exercised in connection with Papal bulls, briefs, or other instruments which were obnoxious to the government of the country or opposed to the spirit of its laws. It is well known that in virtue of their position and the support they gave to the church the early Christian emperors claimed the privilege of legislating on ecclesiastical matters; and during the middle ages the popes had frequent cause for complaint that their free intercourse with their churches was considerably restricted by the sovereigns of several countries. It was laid down as a principle in the treaties of Westphalia (24th October, 1648) that the will of the sovereign of the state is supreme and final within his own territory in all matters of religion. This claim was enforced by the governments of Prussia, Baden, Saxony, Würtemberg, Saxe-Gotha, Saxe-Weimar, and other German Protestant and Catholic states; but was pressed most stringently by Joseph II. of Austria, who rigorously forbade the publication of all Papal bulls, briefs, and constitutions, and all the ordinances of the local bishops, until they had been subjected to his revision. These claims have been naturally obnoxious to the Roman see, and have been and still are the cause of much serious dispute in Germany.

PLACOID SCALES, a variety of scales covering the bodies of the Elasmobranchiate fishes (Sharks, Skates, Rays, &c.) These structures generally consist of detached bony plates or grains, not set closely together, but disposed in a scattered or irregular manner over the skin of these fishes. The larger or plate-like placoid scales generally possess a spine which rises from the centre of the scale, such a structure being well seen, for example, in the Thornback Ray (*Raia clavata*). Professor Agassiz, who proposed to classify fishes by means of the form of their scales, gave to the Elasmobranchii the name *Placoidei*, from the nature of the body-covering. Placoid tubercles occur in a fossil state in the Upper Silurian rocks, these epidermal fossils being referred to the genera Thelodus and Sphagodus, which form the earliest known examples of Plagiostomous fishes. (See PLAGIOSTOMI.)

PLAGAL, in music, the name given by Gregory the Great to the four collateral scales which he added to the four authentic scales of Ambrose. (See GREGORIAN TONES.) The term plagal is now applied to melodies in which the principal notes lie between the fifth of the key and its octave. The plagal cadence consists of the chord of the subdominant followed by that of the tonic. See MUSIC.

PLAGIARISM. See PLAGIUM.

PLAGIOSTOMI, a sub-order of fishes of the order Elasmobranchii. The Plagiostomi ('transverse-mouthed') are represented by the Sharks, Rays, and Skates; the sub-order being distinguished by the bodies of the vertebræ being either bony or at any rate containing osseous elements. The skull is of gristly or cartilaginous material, and does not show a division into separate and distinct cranial bones. The mouth exists in the form of a transverse slit, and is situated on the under surface of the head. No swimming-bladder exists in this group of fishes. The scales are of the 'placoid' variety. (See PLACOID SCALES.) No operculum or gill-cover is present, but the gills (which in all Elasmobranchii exist in the form of pouch-like structures) open each by a distinct cleft. In addition to the external apertures of the gill-sacs, two tubes opening on the upper aspect of the head by two apertures termed 'spiracles,' and which lead into the pharynx or back part of the mouth, convey water to the breathing organs. The teeth are generally numerous in Plagiostomous fishes,

and the palato-quadrate and suspensorial cartilages are separate and move upon the skull. The Plagiostomi include three groups. The Cestraphori, represented solely by the *Cestracion Phillipi* or Port-Jackson Shark, possess a prominent spine in front of each dorsal fin; the hinder teeth are obtusely shaped; the teeth are arranged upon the jaws in a tesselated or pavement-like manner; and by means of this dental apparatus the Molluscs and Crustaceans on which this form feeds are crushed and broken up. The Selachii, forming the second group, include the Sharks and Dog-fishes. These forms are distinguished by the branchial apertures or gill-openings being situated on the sides of the neck. The pectoral fins are placed, as in the generality of fishes, on the breast; and the body is of elongated shape. The last group of Plagiostomous fishes is that of the Batides, represented by the Skates, Rays, and Saw-fishes, in which the gill apertures exist on the ventral or lower surface of the body behind the mouth. The body is flattened from above downwards, its great breadth being produced by the large size of the pectoral or breast fins, which meet in front. The tail is of slender conformation, and usually possesses two or more dorsal fins, whilst it may bear spinous processes of various kinds. The mouth is provided with flat rhomboidal teeth; the eyes and spiracles are borne on the upper aspect of the head, the nostrils being situated on the ventral surface with the mouth and gill apertures. See also SAW-FISH, SHARK, SKATE, RAY, &c.

PLAGIUM, in the Roman law, is the crime of stealing the slave of another, or of kidnapping a free person in order to make him a slave. According to German law it is the getting forcible possession of a man's person, so as to restrain him of his liberty. By Scotch law the crime of stealing an adult person (*plagii crimen*) was punishable with death, and the same punishment has been applied to the stealing of children. The word has given origin to the term *plagiarism*, used for the act of stealing the thoughts and words of another by publishing them as one's own. Plagiarism, though often practised, is not unfrequently charged where a second invention has taken place, since the most striking figures, for instance, are those which are most likely to suggest themselves to a variety of persons. The idea of raising all the roofs of a city, and looking into the interior of the houses, used by Quevedo and Le Sage, might easily occur to a person unacquainted with their works. Such repetitions of course become more and more likely in proportion as the number of books and educated men increases.

PLAGUE, a disease characterized by a contagious typhus and entire prostration of the strength, and certain local symptoms, as buboes, carbuncles, and livid spots (*petechiæ*). The latter are in this connection the peculiar characteristics of the plague, since the former also appear in other malignant diseases. In the beginning the patient generally experiences great mental dejection and debility of body, slight chills alternating with heats, which are afterwards succeeded by a burning heat within and a heaviness about the head; then follows stupor; the eyes are glaring, glazed, or wild and sparkling; the face appears whitish and livid, and the patient is melancholy, morose, or anxious, faint and delirious. In many cases nausea and vomiting occur; the thirst is unquenchable, the tongue reddish or yellowish, the speech indistinct. In the progress of the disease the face often becomes red, the respiration quick and uneasy, and bilious, green, or bloody and black matter is vomited. The delirium often becomes fierce; the urine is sometimes turbid, black, whitish, or bloody; and hemorrhages take place when death does not immediately ensue. Buboes appear in the groins, the armpits, the parotids, and other places, with carbuncles, and small, white, yellowish, or black spots, over the whole body. The fear, anxiety, and despair which seize the patient with the first appearance of the plague increase the danger of the disease. Death in many cases takes place on the first day, and frequently in a few hours after the appearance, but sometimes not till the second, third, or even fifth day. It is considered favourable if the buboes and carbuncles appear at the same time, are very numerous, and terminate in suppuration. They either terminate in suppuration, or become indurated, are healed, or cut out.

In regard to the origin of the plague, and the manner in which it is communicated, very different opinions have been entertained, according to the state of medical science. In early times, when calamitous events, the causes of which were not understood, were attributed to spirits and demons, the plague was also ascribed to their influence. At a later period it was accounted for by changes in the air, poisonous vapours which descended from the atmosphere, or to clouds of insects which were received into the body by inspiration, or in the food, or by absorption through the skin, and thus corrupted the blood. Physicians, according to the tendency of their theories, found the cause in the excess of sulphureous matter in the blood, or in its coagulation or resolution, &c. Many have considered it as not contagious; at present most have been convinced by experience of its contagious character.

The plague is a specific disease, and can originate of itself only in certain countries. It appears to be unknown within the tropics, and the cold weather of high latitudes has been observed to check its advance. In Europe the late summer and autumn months have been marked by its deadliest ravages. Hot weather, bad air and food, and filthiness favour its production and propagation. The nature of the disease seems to consist in a diminution of the vital energy, which may be so rapid and universal that the component parts of the system, particularly the blood, lose their natural properties and become corrupted, and life is destroyed before the nervous system is able to counteract the effects. When the progress of the disease is not so rapid, the vital energy which remains is exhausted by febrile excitements and local inflammation. Dissections have shown collections of coagulated or decomposed fluid, black blood, inflammations of large portions of the skin, and carbuncles in great numbers. The buboes discharge an offensive matter, and extend far inward. The carbuncles which precede the approach of death, and contain dead parts, also generally reach deep inwards. When nature possesses sufficient vigour, the inflammations are on the skin rather than in the interior. The buboes soon terminate in suppuration, and the carbuncles when cut discharge a less corrupt matter, and fall off. The fever is carried off by a violent sweat; the recovery is slow. When the disease is completely developed it is highly contagious: to this are owing the terrible devastations which it causes. From the fact that the great majority, if not the whole of those establishments, as nunneries, hospitals, &c., which have taken the precaution to cut off all communication with their plague-stricken neighbours have escaped the disease, it has been argued by many authorities that direct contact with a patient's person or his clothes is necessary to communicate it.

There is little doubt that the plague appeared in the most ancient times, particularly where a numerous population was crowded together in the warm climates; but we must not consider every disease as the plague which has been so called by historians,

as they often mean by the term nothing more than a malignant disorder prevailing over a considerable extent of country. Among the most famous instances is the plague described in so masterly a manner by Thucydides, which, in the third year of the Peloponnesian war (430 B.C.), ravaged Athens, then besieged by the Spartans. A large number of the inhabitants of Attica had fled into the city. Fear, anxiety, want, or badness of provision, and the corruption of the air caused by the crowded state of the population, produced and propagated the plague in the city. Death generally ensued on the seventh or ninth day. The plague in Jerusalem (A.D. 72), when it was besieged by the Romans, is described by Josephus. In Rome the plague existed (A.D. 77) in the reign of Vespasian; of Marcus Aurelius (170), when it raged over almost all Europe and Asia; of Commodus (in 189); and particularly of Gallienus (in 262), when 5000 persons are said to have died daily in Rome. In Constantinople, in the reign of Justinian (in 544), it raged so violently that 1000 grave-diggers are said to have been insufficient for the interment of the dead. This terrible plague continued its ravages for fifty years with but short intervals. In 565 it appeared under the name of *pestis inguinaria* in Trèves; in 588 in Marseilles. In the seventh century it was in Saxony; in 823 it prevailed all over Germany, and from 875 to 877 was particularly malignant in Saxony and Misnia, as was also the case in 964. In the eleventh century it broke out in Germany at least six times, mostly after or during a famine, and raged with so much violence that it was believed that all mankind was doomed to be swept away by it. This unfortunate belief prevented the taking of effectual means to check it, and apathy in suffering was considered as an act of piety. In some cases, however, the Jews were suspected of having poisoned the wells, as in a time not very remote the Hungarian peasantry suspected the nobility, when the cholera morbus swept away so many of the poorer classes. In the twelfth century the plague prevailed in Germany above twenty-five years. In the thirteenth century it was brought into Europe by the Crusaders. From 1347 to 1350 it traversed all Europe, and was then called the *black death.* Since that time it has never raged with so much violence. Boccaccio, in the introduction to his Decameron, has given a vivid description of its physical and moral effects in Florence in 1348. In the latter half of the fifteenth century it raged in all Europe, and was accompanied with the most terrible sufferings. The historians of that time give the most horrible picture of distress. In the sixteenth century the plague again raged, and in 1563 was introduced into England by the return of an English army from the Continent. Though some means were already taken against the plague—for instance, lazarettos built—yet it raged in Europe during the seventeenth century. In 1603, 1625, 1636, and 1665 it made great ravages in England. In 1720 a Levantine vessel imported the plague into Marseilles, which soon spread all over Provence. In 1771 it nearly swept off the whole of the population of Moscow. In 1795 and 1796 it extended over the countries on the Turkish frontiers, but was checked by the skill of the physicians. It broke out in 1816 at Noia, a town in Naples—its last appearance in Western Europe. It has not appeared as an epidemic since 1835, when it spread over Egypt and Turkey. It never visited the American continent.

The ancients endeavoured to avert the plague by sacrifices, the Christians by processions and prayers. The ancient physicians tried several modes of treatment, among them sweating. The researches of modern physicians have given us a greater insight into the nature of the disease and of its remedies than were possessed formerly, when want of courage was quite as fatal as want of knowledge. Precautions against contagion, and when that has once occurred the speedy expulsion of the poison from the system, the diminution of the internal inflammation, the preservation of the vigour of the arterial blood, the strengthening of the nerves, the promotion of suppuration, the seasonable resolution of the carbuncles, are the main points of the treatment. Baldwin, English consul-general at Alexandria, recommended (1795) oil friction, which has been tried with success. Having observed that the oil porters were never attacked, he concluded that olive-oil was a preservative against the plague; and his expectations were surpassed by the favourable results of his process. As soon as any symptoms of the plague are perceived, the body of the patient is vigorously and quickly rubbed with warm oil, and the patient is put to bed. This application is followed by a profuse sweat, which is promoted by elder tea. The friction is repeated once or twice a day, until a violent sweat is produced. If there are buboes, they must be frequently rubbed with oil until suppuration follows.

Dr. Madden gives the following as the results of his experience, both in regard to the nature of the disease, and the treatment of it:—'I have given plague the name of *typhus gravissimus.* The symptoms from the first are general debility, congestion about the heart, not depending on inflammation, but on the putrescent state of the circulation. It differs little from putrid typhus, except in its duration and eruptions. In every stage of plague nature appears to lie prostrate under the influence of the poisonous miasma; and when the patient sinks at last, it is from the want of force in the constitution to drive out the eruptions on the surface. The bubo recedes, or the carbuncle diminishes, or neither appear at all externally; but they have seized on the internal vital organs, and the immediate cause of death has been shown by dissection to have been carbuncles on the liver, lungs, spleen, or mesenteric glands; in short, it appears that the whole glandular system is the seat of the disease. I have seen all the different species of plague enumerated by Russel and the French authors, and I have no hesitation in pronouncing all these different species of plague to be the symptoms of one class only; and I assert there is but one indication to fulfil, namely, to assist nature to expel the poison by strengthening the exhausted powers of the constitution, and enabling it to throw out the morbific matter. By what means is this to be done?—whether by emetics, by purgatives, by bleeding, by calomel, by mercurial unction, or by oil friction? There is none of these means I have not tried, and out of the first eleven patients so treated I lost nine. I had recourse to another mode of cure; strong stimulants, diffusable and permanent, I now tried. I commenced with wine and brandy the first moment I saw the patient. Whether the eye was suffused, the cheek flushed, and the skin arid, or the low delirium set in or not, I administered it in the following manner:—The first dose was a tumbler of hot brandy and water, about one-third spirit. This sometimes was vomited, and again repeated; the second time it usually remained on the stomach, and in the course of two hours it generally produced perspiration, even after James's powder had failed. Two or three hours after the first dose another was exhibited, and the patient would feel less of the burning pain at the heart. If vomiting supervened it was again repeated, and during the day it was now given every four or six hours, according to circumstances. The buboes commonly increased in size, and profuse sweating was often followed by

petechiæ or livid spots on the chest: when I saw this I was always sure of my patient. The second day I increased the strength of the dose: instead of one-third spirit I gave one-half every eight hours; no intoxication came on, but a lethargic drowsiness was common enough, continuing till the perspiration broke out, or carbuncles appeared externally. If on the third day the patient was decidedly better, I kept up the excitement with strong Cyprus wine, in frequent but small doses of two table-spoonfuls every two hours; but if the bad symptoms were unabated I continued to give the hot brandy and water in increased quantities till some decided change took place. This active treatment it was seldom necessary to pursue beyond the sixth day; indeed, in plague if the patient live to the sixth day he is very likely to recover; but the third day is that which is most to be feared. The only other treatment was once or twice opening the bowels with enemas, for purgatives by the mouth do no service, and sponging the body frequently with vinegar and water; the head was constantly kept soaked with towels dipped in vinegar, and the buboes were poulticed with very hot cataplasms, sufficiently hot to give pain, and they were allowed to burst spontaneously. With this treatment at the rate of 75 per cent. recovered. In Candia, of nine patients five recovered, and some of these were almost hopeless cases when I began to treat them. Everything in plague of course depends on early treatment, for in a disease which commonly runs its course in three days there is no time to be lost.'

PLAICE (*Platessa*), a genus of Teleostean fishes, included in the division Anacanthini, and forming a representative genus of the family Pleuronectidæ or so-called 'Flat-fishes.' It is, however, to be clearly understood that these fishes are only and truly *flattened* in the sense that the *sides* of the body are more compressed than in other fishes. The broad or flat surfaces of the body are not the back and belly, as is commonly supposed, but the *sides* of the fish. This may be demonstrated by noticing that the paired pectoral fins are placed one on each side, as in all other fishes. The eyes, which curiously enough are situated both on one side of the body, are thus placed from the bones of the head becoming twisted, so as to bring the eyes to the one side. One side of the body is darker than the other, the light or whiter side being that upon which the fish lies, and which is undermost when it swims. The head is thus asymmetrical. In the Plaice the eyes are situated on the right side of the body, the nearly allied Turbots possessing the eyes on the left side. The single, long, and continuous dorsal fin in the Plaice begins over the eyes, and nearly joins the tail fin, the anal fin on the opposite or ventral aspect of the body being similarly disposed. Both anal and dorsal fins are somewhat pointed towards the middle, this conformation imparting a rhomboid form to the outline of the body. The Plaice (*Platessa vulgaris*) attains an average length of 12 or 18 inches. The dark or upper side is coloured brown, spotted with red or orange; the body is comparatively smooth; the ventral fins are situated on the throat, and are thus jugular in position; the mouth is of small size, and provided with small teeth. About 33,000,000 of Plaice are said to be annually consumed in London alone (Mayhew). These fishes are all 'ground-fishes,' that is, feed and swim near the bottom of the sea. They are caught chiefly by means of trawl-nets. The swimming-bladder is wanting in the Plaice. The Flounders and Dabs are included in the same genus as the Plaice.

PLAIN (geography), a tract of country of nearly uniform elevation. Plains receive a variety of names in different countries, as *steppes* in Russia and Asia; *deserts* in Asia and Africa; *savannas*, *prairies*, *pampas*, &c., in America. Elevated plains are called *plateaus* or *table-lands*. See the separate articles.

PLAIN-SONG, the name given to the old ecclesiastical chant in its most simple state, and without harmonic appendages. The origin of plain-song in the church is lost in antiquity, and the mode of performing it is left to conjecture, which has by no means been happy in elucidating the subject. The earliest notation, which is in notes of equal length and without division, that is to say, without time or rhythm, leaves everything uncertain, except perhaps the fact that it could not have been so performed, and that the notation was then probably only an inadequate representation of what was orally taught, a mere assistance to the memory of the performer, and not an exact representation of the points of the performance. The plain-song may in some cases have been merely a kind of chant in unison, but the practice of the ancient church was probably not uniform. Ambrose of Milan and Gregory the Great introduced certain reforms into the church music of their day, regarding which see GREGORIAN TONES.

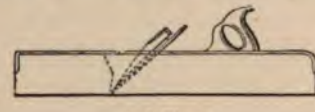
PLAINTIFF, in English law, the person who commences a suit against another in law or equity.

PLAN, in architecture, a drawing showing the design of a building, chiefly used in reference to horizontal drawings, showing the disposition of the various floors of the building. The term is also applied to the draught or representation on paper of any projected work, as the *plan* of a city or of a harbour.

PLANARIDA, a sub-order of Scolecida, included in the order Turbellaria, and represented by free or non-parasitic forms, exemplified by the typical genus Planaria and other allied forms. The Planarida are nearly related in structure to the *Distomæ* or Flukes. (See PARASITES.) They occur in the sea and also in fresh waters, or they may be found inhabiting moist earth and similar damp situations. The Nemertida or Ribbon-worms (see NEMERTIDA), inhabiting the sea, form the second group of the Turbellaria, and are allied to the Planarida in many points of organization. The Planaridans are all of small size, and are found on stones and marine plants at low-water mark, as well as on fresh-water plants. The body is soft, oval or elliptical in shape, flattened, and abundantly provided with cilia. By means of the latter appendages locomotion is subserved, although these forms also appear to move by contracting their bodies, or by aid of their suckers. Muscular fibres, according to Duges, are wanting in most of these forms. The integument of Planaridans is also furnished with cell-like structures, resembling the 'thread-cells' or 'nematocysts,' so characteristic of Cœlenterate animals. The mouth is placed towards the front portion of the body, or in the middle of the ventral surface; the portion in front of the mouth, termed the *prostomium*, being modified to form a proboscis, which appears to be used for suctorial purposes. The pharynx may be protrusible, and the digestive system consists either of a branched or tree-like arrangement of the intestine or of a straight alimentary tract; but in neither case does it terminate in a vent or anus. A 'water-vascular' system of tubes is developed, and this system opens externally by two or more apertures, which are contractile in nature. A double nervous ganglion, placed near the mouth, constitutes the nervous system; whilst several pigment spots or 'eyes' exist in the anterior part of the body. Reproduction may take place asexually by fission or division of the body-substance, and by gemmation or internal budding. The male and female reproductive organs are situated in the same individual, but the sexual union of two such

hermaphrodite individuals appears necessary for impregnating the ova. The Planarida are divided into two chief sections. The first of these includes those Planaridans in which the intestine is straight, not branched, and possessing a rounded, oval, or elongated body. This group is accordingly named *Rhabdocœla*, and of this division the *Convoluta paradoxa* may be selected as a familiar example. Eyes are wanting in this form. The *Dendrocœla* form the second group, these latter Planaridans possessing a branched intestine and a broad flat body. The genus *Planaria*, of which the species *P. lactea*, *P. nigra*, *P. tremellaris*, and *P. flexilis* may be selected as examples, is included in this section. The genera *Eurylepta* and *Leptoplana* of Ehrenberg are nearly allied to the genus *Planaria*, and are sometimes included to form a third group, known as the *Cryptocœla*. These forms are distinguished by the large mouth-opening in the middle of the ventral surface, and by possessing the eyes arranged in groups.

PLANE. The plane is a cutting instrument on the guide principle. It is, in fact, a chisel guided by the stock or wooden handle in which it is set. The guide or sole of the stock is in general an exact counterpart of the form it is intended to produce. Planes are of various kinds, as the *jack-plane* (about

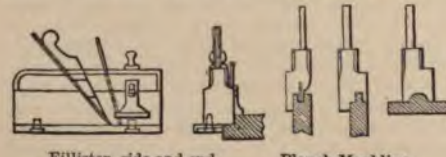


Jack Plane.

17 inches long), used for taking off the roughest and most prominent parts of the stuff; the *trying-plane*, which is used after the jack plane; the *long-plane* (26 inches long), used when a piece of stuff is to be planed very straight; the *jointer*, still longer than the former, which is used for obtaining very straight edges; the *smoothing-plane* ($7\frac{1}{2}$ inches long) and *block-plane* (12 inches long), chiefly used for cleaning

Smoothing Plane. Compass Plane. Rebate Plane.

off finished work, and giving the utmost degree of smoothness to the surface of the wood; the *compass-plane*, which is similar to the smoothing-plane, but has its under surface convex, its use being to form a concave cylindrical surface. The foregoing are technically called *bench-planes*. There is also a species of planes called *rebate-planes*, the first of which is simply called the *rebate-plane*, being chiefly used for making rebates. Of the sinking rebating planes



Fillister, side and end. Plough Moulding.

there are two sorts, the *moving-fillister* and the *sash-fillister*, the first for sinking the edge of the stuff next the workman, and the second for sinking the opposite edge. The *plough* is a plane for sinking a channel or groove in a surface, not close to the edge of it. *Moulding-planes* are for forming mouldings, and must vary according to the design. The *bead-plane* is used for mouldings whose section is semicircular. Planes are also used for smoothing metal, and are wrought by machinery. See PLANING-MACHINE.

PLANE, INCLINED. See INCLINED PLANE.

PLANE-TREE (*Platanus*), the name of a genus of trees belonging to the natural order Platanaceæ. *P. occidentalis* is the American Plane-tree or Button-wood. The Occidental Plane is one of the largest productions of the American forests. It abounds most and attains the largest size along the interior waters of Pennsylvania and Virginia, and especially along the banks of the Ohio. Here stems are sometimes found from 10 to 14 feet in diameter, often beginning only to give out their vast branches at the height of 60 or 70 feet, and near the summits of the surrounding trees. A moist and cool soil seems indispensable, for it is never found on dry grounds. In the Western States this tree is usually known by the name of *sycamore*, and in some districts is called *cotton-tree*. The trunk and branches are covered with a smooth, pale-green bark, the epidermis of which detaches itself in portions; the roots when first taken from the earth are of a beautiful red colour, which disappears on exposure to light in a dry place; the leaves are alternate, palmated, or lobed; and the flowers are united in little globular, pendent balls. The wood in seasoning takes a dull red colour, is fine-grained, and susceptible of a good polish, but speedily decays on exposure to the weather. The Oriental Plane (*P. orientalis*), so celebrated by the ancients for the majesty of its appearance, resembles the preceding, and bears the same relation to the forests of Western Asia. It is supposed to be the tree whose Hebrew name is translated 'chestnut-tree' in the English Bible. The wood in those regions where it abounds is frequently employed in the arts. The *Acer Pseudo-platanus*, the Common Sycamore or Greater Maple, is called in Scotland the plane-tree. See MAPLE.

PLANET, a name given originally to those celestial objects which change their places in the heavens, but which is now given to any body, like the earth, which revolves in an elliptic, nearly circular, orbit round a sun, and which shines by reflected light. The known *major* planets are, in the order of their proximity to the sun, Mercury, Venus, the Earth, Mars, Jupiter, Saturn, Uranus, and Neptune. Mercury, Venus, Mars, Jupiter, and Saturn were known to the ancients. The *minor* planets form a zone of asteroids between the orbits of Mars and Jupiter. Kepler, Titius, and Bode, observing indications of relations existing among the planetary distances, constructed the well-known 'Bode's law.' This empirical law is: Adding the constant number 4 to every term of the series 0, 3, 6, 12, 24, &c., gives the relative distances of the planets from the sun. The numbers so obtained correspond closely with the true relative distances except in the case of Neptune. Gauss remarked that the series 0, 3, 6, &c., is not a true progression; on inverting it we get ... 6, 3, 0 instead of ... 6, 3, $1\frac{1}{2}$. Supposing the law to apply only to the distances of Venus, the Earth, &c., from the orbit of Mercury, the distances increase in a real geometrical progression—3, 6, 12, &c., a complete and simple form of the law. The relative distances of Jupiter's satellites from the planet are expressed by adding 7 to each term of the series 4, 10, 25, 62·5, the constant multiplier being $2\frac{1}{2}$. In Saturn's system the constant number to be added is 4, and the series 1, 2, 4, 8, &c. On the discovery of the planet Uranus, whose mean distance coincides with that calculated from Bode's law, Bode asserted that astronomers might with advantage search for a planet between the orbits of Mars and Jupiter, a part of the heavens

in which no planetary body had as yet been observed. Piazzi soon afterwards (1801) discovered Ceres, the first of the minor planets, and since then scarcely a year has passed without a new name being added to the list of these bodies. The law fails in the case of Neptune, yet perhaps neither Adams nor Leverrier would have attempted by calculation the discovery of this planet had they not been assured by the law that the planet lay within certain limits of distance.

The intra-asteroidal planets are all small compared with the extra-asteroidal, but in these two families there is no trace of a law as to relative size. The extra-asteroidal planets seem to rotate axially in periods of about ten hours; the axial periods of the intra-asteroidal are about twenty-four hours. The directions of axial rotation seem to be in every case the same, being the common direction of rotation about the sun (the case of Neptune being still regarded as doubtful, however). The inclinations of axes differ considerably. The orbits are all nearly in the plane of the ecliptic, but with regard to the medial orbital plane the orbits are more nearly alike in their inclinations.

The elements of the planets and their satellites (omitting the moon) are given in the following tables. Pl. XII.–XIII. exhibit the most important relations existing among the elements of the planets.

	Distance from the Sun.			Distance from the Earth.		Time of Revolution round the Sun.	Synodic Revolution.
	Mean.	Greatest.	Least.	Greatest.	Least.		
	Miles.	Miles.	Miles.	Miles.	Miles.	Mean Solar Days.	Mean Solar Days.
Mercury	35,393,000	42,666,000	28,120,000	135,631,000	47,229,000	87·9692	115·887
Venus	66,131,000	66,586,000	65,677,000	159,551,000	23,309,000	224·7007	583·920
The Earth	91,430,000	92,965,000	89,895,000	....	....	365·2563	....
Mars	139,312,000	152,284,000	126,341,000	245,249,000	62,389,000	686·9794	779·936
Jupiter	475,693,000	498,604,000	452,783,000	591,569,000	408,709,000	4332·5848	398·867
Saturn	872,135,000	921,105,000	823,164,000	1,014,071,000	831,210,000	10759·2197	378·090
Uranus	1,753,851,000	1,835,701,000	1,672,001,000	1,928,666,000	1,745,806,000	30686·8205	369·656
Neptune	2,746,271,000	2,770,217,000	2,722,325,000	2,863,183,000	2,629,360,000	60126·722	367·488

	Time of Rotation on Axis.			Inclination of the Planet's Equator to its Orbit.			Ascending Node of Equator on Orbit.		Equatorial Diameter.	Planet's Mass, Earth's = 1.	Bodies fall in 1 Second.	Density, Earth's = 1.	Volume, Earth's=1.	Apparent Diameter as seen from the Earth.	
														Greatest.	Least.
	h.	m.	s.	deg.	min.	sec.	deg.	min.	miles.		feet.			sec.	sec.
Mercury	24	5	28	?			?		2,962	0·065	7·45	1·24	0·052	11·5	4·5
Venus	23	16	19	49	58	0	56	30	7,510	0·785	14·05	0·92	0·851	62·0	9·5
The Earth	23	56	4	23	27	24	0	0	7,901	1·000	16·08	1·00	1·000	..	..
Mars	24	37	23	28	51	0	79	1	4,920	0·124	4·88	0·92	0·139	23·5	3·3
Jupiter	9	55	28	3	4	0	313	22	85,390	300·857	38·89	0·22	1387·431	46·0	30·0
Saturn	10	29	17	26	49	0	171	43	71,904	90·032	17·59	0·12	746·898	20·5	14·6
Uranus	?			100	20	0	165	15	33,024	12·641	11·71	0·18	72·359	4·3	3·5
Neptune	?			?			?		36,620	16·761	12·62	0·17	98·664	2·7	2·6

Primary.	No.	Name of Satellite.	Distance from Primary.	Sidereal Revolution.			Inclination of Orbit to Plane of Ecliptic.			Diameter.	Apparent Star Magnitude.	Name of Discoverer.
			miles.	d.	h.	m.	deg.	min.	sec.	miles.		
Mars	1	Phobos.	5,800	0	7	38	?			?	?	Prof. Hall (U. States).
	2	Deimos.	14,500	1	6	14						
Jupiter	1	Io.	267,380	1	18	27	3	4	6	2,252	7	Galileo.
	2	Europa.	425,160	3	13	14	3	5	5	2,099	7	
	3	Ganymede.	678,390	7	3	43	3	9	2	3,436	6	
	4	Callisto.	1,192,820	16	16	32	3	28	0	2,929	7	
Saturn	1	Mimas.	120,800	0	22	37	23	10	22	1,000	17	Sir W. Herschel.
	2	Enceladus.	155,000	1	8	53				?	15	"
	3	Tethys.	191,000	1	21	18				500	13	Cassini.
	4	Dione.	246,000	2	17	41				500	12	"
	5	Rhea.	343,000	4	12	25				1,200	10	"
	6	Titan.	796,000	15	22	41				3,300	8	Huyghens.
	7	Hyperion.	1,007,000	21	7	8				?	17	Bond and Lassell.
	8	Japetus.	2,314,000	79	7	55				1,800	9	Cassini.
Uranus [Motion of Satellites retrograde.]	1	Ariel.	123,000	2	12	23	100° 34′ Ascending Node			?	?	Lassell.
	2	Umbriel.	171,000	4	3	27				?	?	O. Struve.
	3	Titania.	281,000	8	16	55				?	?	Sir W. Herschel.
	4	Oberon.	376,000	13	11	6	165° 30′			?	?	"
Neptune [Motion possibly retrograde.]	1	....	220,000	5	21	8	157?	0		..	14	Lassell.

As the axes of rotation of the planets are inclined to their orbits, and as they have all equatorial protuberances, their axial motions are precessional and nutational rotations. (See PRECESSION.) One of the most interesting problems in astronomy is that which was first solved by Lagrange when he enunciated the laws relative to the stability of the solar system. Laplace showed in 1784 that in any system of bodies rotating in the same direction round a central attracting orb, the eccentricities and inclinations, if small at any one time, will always remain inconsiderable.

PLANETARIUM. See ORRERY.

PLANIMETER, Amsler's, an instrument by means of which the area of a plane figure may be measured. It is employed by surveyors in finding areas on maps, &c. It consists of a rod C B, which may be attached to the paper on a drawing-board by means of a pin at C, which is the centre of a circle described by B. B A P is a second straight rod jointed to the first at B; at the end P there is a pointer which is to be carried round the boundary of the area to be measured. A wheel at A on this rod, nearer B than C, has a thin edge, which enables it to roll without sliding on the paper in a direction at right angles to the rod B P. The rim of this wheel is graduated, and an index fixed to the rod enables the amount of motion of B P in a direction at right angles to its length to be measured. Now the area swept out by the rod B P during any motion in a plane is equal to the length of the rod multiplied by the amount of its normal motion; hence this area is known from the readings of the wheel if we adopt the well-known algebraic convention as to positive and negative areas. When the centre C is external to the area to be measured, a rough sketch will show that the reading of the wheel represents this area. When C is inside, to the reading of the wheel a constant must be added expressing the area of the circle described by B. In every case the reading of the wheel must be multiplied by a particular constant depending on the scale of the drawing.

PLANING MACHINE, a tool or instrument wrought by steam power, for saving manual labour in producing a perfectly plane surface upon wood or metal. This is usually accomplished in metal-planing machines by such an arrangement of mechanism as will cause the object which is to be operated upon to traverse backwards and forwards upon a perfectly smooth and level bed, while the cutting tool is fixed to a cross slide above it, and slightly penetrates the surface as it is carried along. The tool is acted upon by screws, so as to enable the attendant to adjust the depth of the cut, and to move it with unerring precision over every part of the surface which it is required to plane.

PLANT. See Botany.

PLANTAGENET, a family, the various branches of which occupied the throne of England from the reign of Henry II. (1154) until the accession (1485) of Henry VII., the representative in the female line of the Lancastrian branch of it, who, by his marriage (1486) with Elizabeth of York, daughter of Edward IV., representative of the York branch, united its various branches in the house of Tudor, of which he was the direct descendant. On the death of Henry I. the crown was claimed by his daughter, Maud or Matilda, first married to Henry V., emperor of Germany, and afterwards to Geoffroi V., count of Anjou, surnamed Plantagenet, on behalf of her son by the latter, Henry Plantagenet. Stephen obtained it during his lifetime, and was succeeded on his death by Henry, who became the head of the Plantagenet kings. The name is said to have been derived from the circumstance of the Count of Anjou wearing a branch of broom (*plante de genêt*) in his cap. The direct line became extinct in Richard II. (1400), before whose death the crown was usurped by Henry IV., son of John of Gaunt, duke of Lancaster, fourth son of Edward III., in prejudice of Edmund and Anne Mortimer, the descendants of Lionel, duke of Clarence, third son of the same Edward. He was succeeded by his descendants Henry V. and Henry VI., and during the reign of the latter Edmund Mortimer having died without heirs, Richard, duke of York, son of Anne Mortimer, who had married the heir of Edmund, duke of York, fifth son of Edward III., claimed the crown. This occasioned the war of the Roses, which terminated in the accession of Henry VII. as above mentioned. See England.

PLANTAIN (*Plantago major*), a common weed, the leaves of which are all radical, oval, and petiolate, and from amongst them arise several long cylindrical spikes of greenish inconspicuous flowers. It is found in meadows, fields, and on the borders of roads. Its leaves, which are slightly astringent, were formerly regarded as a febrifuge, and were also prescribed for dysentery and spitting of blood. Water of plantain is still used as a vehicle in some eye-salves.

PLANTAIN-EATERS, a group of Perching birds belonging to the Conirostral section of that order, and included in the family Musophagidæ. These birds occur exclusively in Africa. The bill is of moderate size, of compressed form, broad at its base, the tip being notched and the ridge curved. The toes are elongated; the outer toe can be turned backwards at will; a disposition of the feet relating these forms to the Scansorial or Climbing birds, in which group they have been included by some ornithologists. The tarsi are covered by large scales. The genus *Musophaga* includes the most typical forms. These birds chiefly feed upon the fruit of the banana and plantain. In this genus the base of the bill appears as a broad plate covering the forehead. The plumage exhibits brilliant coloration. The *Musophagæ* inhabit tropical Africa. The members of the genus *Corythaix* or *Touracos* possess a bill of ordinary size and conformation, and an erectile crest, borne on the head. The general colour is green, the quills of the wings and tail being coloured red. They feed on insects, in addition to fruits, and are said to be exceedingly familiar and tame in habits even in a wild state. They attain a size averaging that of the common pigeon or crow.

PLANTAIN-TREE, the type of the natural order Musaceæ. *Musa paradisiaca*, the plantain, and *M. sapientum*, the banana, are cultivated in mostly all tropical countries. They are magnificent palm-like trees, the stems of which grow to a height of 20 or more feet, bearing on their summits eight or ten large leaves, each 5 or 6 feet long, and 18 inches in breadth. These leaves, the most remarkable for size in any known plant, spring from long stout petioles, the bases of which form the stem. The dried leaves supply thatch for the Indian cottages, and serve the natives for many other economic purposes. The fruit of both species is extensively used as food by the natives of the tropics. The flower-spike springs from the centre of the tuft of leaves, and consists of an immense number of florets. As the florets of the base become mature the fruit swells out, and the other florets are pushed forward, until the stalk on which they are borne reaches the length of 3 or more feet, and produces sometimes fruits to the number of 150 to 180, weighing together from 60 to 70 lbs. Each fruit is about 6 inches long, straight, and about an inch in diameter, rather shorter and thicker in the banana than in the plantain. When ripe the fruit is of a pale yellow colour, and has a luscious, sweet pulp. It is one of the most useful fruits in the vegetable creation, and, as some of the plants are in bearing most of the year, forms the main sustenance of millions of the inhabitants of tropical climates. When used as bread it is roasted or boiled when just full grown; and when ripe, it is made into tarts, sliced and fried with butter, or dried and preserved as a sweetmeat. Three dozen plantains are esteemed sufficient to serve one man for a week, instead of bread.

PLANTATION (1st), a term anciently used to designate a colony. Plantations, according to Black-

stone, are colonies where the lands are claimed by the right of occupancy only, by finding them desert and uncultivated, and peopling them from the mother country; or where, when already cultivated, they have been either gained by conquest or ceded by treaties.

(2d), A wood or piece of ground covered with trees. Various acts of the Scottish Parliaments were passed to encourage planting and inclosing, and to punish those who should injure or destroy trees or plantations. At common law injuries done to trees or plantations are punishable as malicious mischief, and by statute two justices of the peace may impose penalties for such injuries. The penalties are, for setting fire to trees, breaking, cutting, or peeling them, £10 Scots for each tree under ten years of age, and £20 for each tree over that age.

In England, by 24 and 25 Vict. cap. xcvi. s. 32, if any person steal, cut, break, root up, or otherwise destroy or damage, with intent to steal any tree, sapling, shrub, or underwood growing in a park, pleasure-ground, garden, orchard, or avenue, or in any ground belonging to any dwelling-house, he is liable if the injury amounts to £1 to penal servitude for three, or imprisonment for two years; for damaging similar property growing in any other situation to the extent of £5, with intent to steal, he is liable to the same penalty. For stealing any of these articles to the value of 1*s.* wheresoever growing he is liable to a fine of £5, besides the value of the article, for the first offence; for the second, he is liable to hard labour in the house of correction for twelve months, and if the conviction be before two magistrates to whipping; for a third offence, to penal servitude, or imprisonment as above. The same penalties are inflicted by cap. xcvii. s. 19 for maliciously injuring (without intent to steal).

PLANTIGRADA, PLANTIGRADES, the term applied in zoological science to such Mammals as walk with the whole sole of the foot applied to the ground. The name Plantigrada is, however, more specifically used to indicate a section of the order Carnivora (which see), represented typically by the Ursidæ or Bear family, and also by other less familiar forms, such as the Racoons, Coatis, and the Badgers. The sole of the foot in these forms is usually destitute of a hairy covering. The conformation of the feet enables these animals to assume the semi-erect position with ease. The feet are five-toed. The intestine wants a cœcum. Some carnivorous forms, exemplified by the Mustelidæ or Weasels, and by the Viverridæ or Civets, are collectively termed *semi-Plantigrada*, from the fact that they apply part of the sole to the ground in walking, and thus link together the Plantigrades and those Carnivores (for example, Cats, Lions, Tigers, Dogs, &c.) which walk on the tips of the toes, and which are hence termed Digitigrada.

PLANT-LICE (Aphides), an interesting group of Hemimetabolic insects, belonging to the order Hemiptera, and to the Homopterous section of that order. These insects possess short oval bodies, six legs, and a pair of antennæ. They exhibit an alternation of winged and wingless individuals, the reproduction of these insects forming one of the most peculiar phases which can well be conceived of in the generation of animal forms. Their reproductive history is described at length in the article on PARTHENOGENESIS (which see). When wings are developed the front pair are membranous throughout their entire extent. The rostrum or 'beak' springs from the breast or posterior portion of the head, the mouth being turned backwards. The tarsi are composed of two joints, and are provided with two claws. These insects are specially notable on account of their destructive effects upon vegetation of all kinds. They live upon plants, and imbibe by means of their suctorial mouths the juices of the plant tissues, causing the decay or death of the vegetables. Many species of Aphides are known. The *Aphis Rosæ* of the rose bushes is a very familiar species; *A. Rapæ*, of a green colour, infests turnips; *A. Fabæ*, coloured black, lives upon the bean; *A. vastator* attacks the potato and other plants. The leaves of the infected plants wither, curl up, and become distorted when attacked by these insects. The Woolly Aphis (*A. lanigera*), so named from a kind of woolly substance covering the body, attacks apple-trees. This insect first appeared in England in 1787, and from the supposition that it was imported from America the popular name of 'American Blight' has been applied to it. The Hop Aphis (*A. Humuli*) is a species upon the absence or presence of which the prosperity or failure of the hop crop may in some seasons chiefly depend. Vast differences in the returns from the hop duty, representing the increase or deficiency of large sums of money, may in this way be said to depend upon these minute pests. The Aphides possess glandular structures opening at the extremity of the abdomen in little tubular orifices, which secrete a sweet, viscid fluid, of which ants are very fond. And the ants regularly 'milk' the Aphides by stroking their abdomens for the sake of this sweet liquid, which exudes from the glands in drops. The larvæ of the Coccinellæ or 'Lady-bird' beetles are very destructive to the Aphides; these immature beetles and also the adult lady-birds devouring the plant lice in great numbers, and thus aiding in limiting the rapid increase of the pests.

The remarkable fecundity of the plant-lice forms one of the chief notable points in their economy. It has been calculated that the progeny of a single aphis traced to the fifth generation only, may number 5,904,900,000, and in one year the progeny of one female may number 100,000,000,000,000,000! The eggs produced by male and female insects are deposited on the axils of leaves during the autumn. These are hatched during the succeeding spring, and females alone are produced. These females, or 'fruitful virgins,' as they are called, continue to produce similar and female beings viviparously, and without the presence of any *male*, till the ensuing autumn. See PARTHENOGENESIS.

PLANTS, INJURY TO. By 24 and 25 Vict. cap. xxxvi. if any person steal, destroy, or damage with intent to steal any plant, root, fruit, or vegetable production growing in any garden, orchard, nursery ground, hothouse, greenhouse, or conservatory, every such offender shall, at the discretion of the justice, either be committed to be imprisoned only, or to be imprisoned or kept to hard labour for any term not exceeding six months, or else pay, over and above the value of the article stolen, or the amount of the injury done, any sum not exceeding £20. On a second conviction the offender is liable to penal servitude for three years, or imprisonment not exceeding two years. If any person steal, destroy, or damage with intent to steal, any cultivated root or plant used for food of man or beast, or for medicine, distilling, or dyeing, growing in any land, whether inclosed or not inclosed, not a garden, orchard, &c., he may be committed for one month, with or without hard labour, and a second conviction for six months, with or without hard labour. See also PLANTATION.

PLASENCIA (ancient *Ambraca*), a town in Spain, Estremadura, on the Jorte, 120 miles W.S.W. of Madrid. Its walls, flanked by numerous towers, are crumbling to pieces, but the streets are generally well formed, and the houses well built. The principal buildings are a Gothic cathedral, built of granite finely sculptured, the episcopal and several private

palaces, the seminary, aqueducts, bridges, &c. It was sacked and almost destroyed by Soult in 1809. Its chief industrial establishments are tanneries, and silk, oil, and flour mills. Pop. 6026.

PLASSEY, a village in Hindustan, on the Hugli, 80 miles north of Calcutta. Here on June 23, 1757, Colonel, afterwards Lord Clive, with a mere handful of men, consisting of about 900 Europeans and 2100 sepoys, defeated Suraja Dowla, with an army consisting of 50,000 foot and 18,000 horse, and laid the foundation of the British Empire in India.

PLASTERING is the art of covering the surface of masonry or wood work with a plastic material in order to give it a smooth and uniform surface, and generally in interiors to fit it for painting or decoration. In plastering the interior of houses a first coat is generally laid on of lime, thoroughly slacked, so as to be free from any tendency to contract moisture, and mixed with sand and cow's hair. The face of the first coat, which should be of considerable thickness, is trowelled, or indented with cross lines by the trowel, to form a key for the finishing coats. The second coat is applied to this when it is thoroughly dried. It is rubbed in with a flat board so as thoroughly to fill the indentations and cover the unequal surface of the first coat with a smooth and even one. In plastering walls great care must be taken to have the surface perfectly vertical. The setting coat, which is of pure lime, or for mouldings or finer work of plaster of Paris or stucco, is applied to the second coat before it is quite dry. A thin coating of plaster of Paris is frequently applied to roofs after the setting coat.

PLASTER OF PARIS. See PARIS (PLASTER OF).

PLASTERS are applications of local remedies to any part of the surface of the body by means of a supporting texture of leather, silk or other cloth, or merely of paper, and frequently with the aid of some adhesive substance. Plasters may be intended merely to give protection, support, or warmth, as in the case of wounds, bruises, or local weakness, or they may be actively medicinal, in which a variety of medicines suitable for external application may, according to the particular circumstances of the case, enter into their composition. A largely used class of plasters called blisters has been described under that head. The British Pharmacopœia gives twelve prescriptions for plasters, in most of which the adhesive property is due to the combination of oxide of lead with fatty acids. The materials most frequently used in plasters are belladonna, cantharides, galbanum, isinglass, lead, mercury, opium, pitch, resin, iron, and soap.

PLATA, LA, UNITED PROVINCES OF, now commonly called the ARGENTINE CONFEDERATION or ARGENTINE REPUBLIC, a vast region of South America, bounded on the south by the Rio Negro, west by the Cordilleras of Chili and Bolivia, north by Bolivia, and east by Paraguay, Brazil, Uruguay, and the Atlantic Ocean. It is divided into fourteen provinces, the area and population of which are as under:—

	Area in sq. miles.	Pop. in 1882.
Buenos Ayres (federal capital)	—	295,000
Buenos Ayres (province)	63,000	612,000
Santa Fé	18,000	187,000
Entre Rios	45,000	188,000
Corrientes,	54,000	204,000
Rioja	31,500	87,000
Catamarca	31,500	102,000
San Juan	29,700	91,000
Mendoza	54,000	99,000
Cordova	54,000	320,000
San Luis	18,000	76,000
Santiago del Estero,	31,500	158,000
Tucuman	13,500	178,000
Salta	45,000	167,000
Jujuy	27,000	66,000
Total	515,700	2,830,000

To this have to be added the area and population of the following national territories:—

	Area in sq. miles.	Pop. in 1882.
Gran-Chaco	125,612	45,291
Missiones (1879)	23,932	32,472
Pampas	191,842	21,000
Patagonia and Fuego	268,000	24,000
Total	609,386	122,763

By the treaty of 23rd July, 1881, Chili recognized the right of the Argentine Republic to all the country east of the crest of the eastern ridge of the Andes, including most of Patagonia and a small portion of Tierra del Fuego. The official estimate of the total population at the end of 1882 was 3,026,000, of whom 363,745 were foreigners, mostly Italians, Spaniards, and French.

Among the Andes on its western border snowy heights and volcanic peaks occur; lower down there are well-watered hilly regions, while at the foot lie habitable low tracts. In some places lateral branches from the high Andes run into the plain to a distance of 150 or 200 miles, and the mountains cover a considerable portion of the north-west of the territory. The eastern portion also round the river Paraguay is hilly. The plains south and south-west of Buenos Ayres at a distance of 150 miles become hilly: and chains of hills never rising 300 feet above the plain extend from south-east to north-west. Further to the south-west the Ventana Mountain rises 2500 feet above the plain, which is itself from 800 to 900 feet above the sea-level. But the mountainous tracts form but a small portion of the whole territory, which generally spreads out into immense uniform plains called Pampas. Though there are some large rivers either in the country or forming its boundaries, a great portion of the Pampas is sterile for want of irrigating streams. The Rio de la Plata, or river Plate, which runs for more than 200 miles between the Argentine Republic and Uruguay is not, strictly speaking, a river, but rather an estuary, receiving the rivers Paraná and Uruguay. The former has its origin in Brazil, and forms for some distance the dividing line between Paraguay and Brazil and then between Paraguay and La Plata, till at its junction with the river Paraguay it leaves the former country and continues its course solely in the Argentine territory. The Uruguay separates for a great part of its course Brazil and the republic of Uruguay from the Argentine Republic. The other rivers, such as the Pilcomayo, the Vermejo, the Salado, &c., mostly flow in a south-easterly direction and enter the Paraguay or the Paraná. The Colorado, not far from the south border, and the Negro, which separates it from Patagonia, rising in the Andes, flow in a south-easterly direction and enter the Atlantic. The rivers which belong exclusively to the plains are for the most part wasted by evaporation and terminate in occasional lakes, marshes, or salt-pans. These are numerous, the lakes and marshes east of the Paraguay and Paraná being fresh, while those on the west are generally salt. Many of the latter disappear soon after the rainy season, leaving the ground encrusted with salt to the depth of some inches. The Pampas are the most remarkable feature in the surface configuration of this country. As already remarked they are in a great part dry and sterile, though there is an immense extent of good pasture land in the plains around Buenos Ayres, and extending to some distance up the Paraná. In general the cultivable land is confined to the banks of the rivers. Diluvial strata occupy an immense area and contain many fossil remains, among which are those of some Mammalia of colossal size. In the geological formation of the northern part of this great

territory the prevalent rocks are granite, gneiss, and slate. In the south alluvial sands, mixed with numerous shells, are almost exclusively found. The most valuable mineral is salt, which is found both in rocks and deposited in the lakes. There are also mines of gold, silver, copper, lead, iron, zinc, tin, and other metals, and of sulphur, saltpetre and alum, coal, bitumen, asphalte, and other valuable minerals, are found. Very few of the minerals are worked. In a country of such size there is naturally a considerable diversity of climate. The most general climatic feature is dryness, though to this there are, as around and south from Buenos Ayres, important exceptions. The most characteristic quadrupeds are the guanaco or wild llama, the vicuña, the capybara, the tapir, the puma, the jaguar, the vizcacha and tucotuco, allied to the marmot, which live in communities in the plains, burrowing under ground, and several species of armadillo. Among the birds are the condor, the caracara vulture, the gallinazo, the turkey-buzzard or turkey-vulture, the rhea or South American ostrich, parrots, three species of partridges on the Pampas, &c. Horses were introduced by the Spaniards, and now roam over the plains in a wild state in droves of 6000 to 8000. Cattle and sheep, which also have been introduced, are numerous. The plains of La Plata collectively present a rather bare appearance; but the banks of the Paraná are clothed with fine timber, and on approaching the tropics as well as the Cordilleras the vegetation becomes varied and luxuriant. Thousands of square miles west and north-west of Buenos Ayres are covered with the cardoon, a kind of wild artichoke, and the thistle, which grows to such a height as to conceal a man on horseback. The chief wealth, it is obvious, of the provinces consists in the droves of horses, the herds, and the flocks spread over the Pampas. The herds furnish annually for export above 3,000,000 hides, besides salted beef, bones, horns, and hair; horse hides are also exported, goat and sheep skins, and large quantities of fine wool. The trade of the republic has shown generally a steady increase with recent years. In 1880 the imports were valued at £8,813,400, and the exports at £11,295,400; in 1882 the figures were respectively £12,249,232, and £12,077,810. About one-third of the imports came from Britain. Of the exports 55 per cent consisted of wool, and 26 of skins and hides.

The indigenous tribes of La Plata belong to three races—the Araucanian, which includes the Pequenches and others who now roam over the plains as far north as the Rio Salado; the Peruvian, speaking the Quichua language, which now reaches east from the Cordillera as far as Santiago; and the Guaranis or Warranis, who predominate north of the Salado and east of the Paraná, and extend into Brazil. The Spaniards, though comparatively few, are now the dominant race. From their mixture with the native women have sprung up coloured races, differing according to the descent of their mothers, and forming in the remoter districts the majority of the population. In Buenos Ayres and about the shores of La Plata negro slaves were formerly numerous, and their progeny are still distinguishable among the coloured population. There are also considerable numbers of Europeans, chiefly Italians, Spaniards, French, English, and Germans, who as merchants or settlers reside in the Confederate provinces, especially in Buenos Ayres. In Buenos Ayres the better class of people are rapidly adopting European dress and manners. They consume their time in smoking, the siesta, and promenading in the cool of the evening, leaving the business and industry of the place in the hands of foreigners. The Gaucho or rustic is the true type of the Spanish American in and around the Pampas. The Gaucho wears a jacket of coarse cloth or sheepskin, and breeches of the same material open at the knee. He lives in a rude hut constructed of sticks interwoven with osiers and plastered with mud, and subsists almost wholly on beef and water. He is almost continually on horseback galloping over the plains, collecting his herds and droves, taming wild horses, or catching and slaughtering cattle. In such avocations he acquires a marvellous dexterity in the use of the lasso or noose and the bolas or balls. This life of freedom and excitement has its charms; many persons even who are well-to-do do not care to live in a manner very different; and the spirit of the Gaucho, who spends his time in smoking, galloping, or gaming, and cares little for social development or political union, widely pervades the provinces of La Plata.

The La Plata was discovered and named in 1512 by Juan Diaz de Solis, who on a subsequent voyage in 1515 reached the mouth of the Paraná. In 1535 Don Pedro de Mendoza, on his way to Paraguay, built a fort on the present site of Buenos Ayres, but that was soon destroyed by the Indians; and it was not till 1580 that Don Juan de Garay took formal possession of the country and founded the city. At that time, and for nearly two centuries afterwards, the whole country from the mouth of the Plata to the Pacific Ocean, Paraguay included, was comprised in the viceroyalty of Peru. The only advantage then recognized in the provinces connected with the Paraná was that they afforded a communication with Peru. But the expectations thus conceived proved delusive, and La Plata became the channel, not of a legitimate so much as of a contraband trade. In order to check this evil by vigorous government La Plata, comprehending all the Spanish dependencies east of the Cordilleras, was severed from Peru in 1776 and erected into an independent government. In 1809 the conquest of Spain by the French released the Spanish-American governments from their ties with the mother country, and the revolutions which then followed narrowed the limits of La Plata; Tarija and some other districts on the Cordilleras being annexed to Bolivia, while Paraguay became independent. The commercial prosperity of the interior provinces associated with Buenos Ayres depended wholly on the latter, which commanded the entrance of the Paraná and the intercourse with Europe. But Buenos Ayres failed signally in the attempt to establish freedom on a basis of good order and stability; and in respect to the associated provinces it was always actuated by a selfish policy. Hence the discontent and disorders of the state. Between 1810 and 1835 Buenos Ayres had no fewer than thirty-six changes of government. In 1853 a constitution was drawn up in which Buenos Ayres was expressly nominated as the capital of the confederation, in hopes of inducing this powerful state to join the others; but it was not till 1862 that Buenos Ayres became a permanent member of the republic. In 1865 a war commenced with Paraguay, which did not cease till 1870, though the Argentines had the Brazilians as their allies. See PARAGUAY. By the constitution of 1853 the government is a representative confederation. The Roman Catholic religion is recognized as that of the state. The federal government has the right to intervene in the provinces in case of sedition. The different provinces cannot establish separate customs duties. The legislative power is vested in a congress of two chambers. There is one deputy to the chamber of deputies for every 20,000 inhabitants. The deputies are elected for four years, and are re-eligible. The senate consists of two members from each state, elected for nine years by the legislatures. The head of the executive has the title of president. He and the vice-president

are elected as in the United States. The term of office is for six years. The estimated revenue, according to the budget for the year 1884, was £6,492,000, the estimated expenditure £6,452,000. There is a total public debt of £40,000,000 or £45,000,000 sterling, besides the debts due by the separate provinces. The army consisted in 1883 of 7518 men, the militia and national guards 350,000; the navy comprised one sea-going iron-clad, two armoured monitors, six gunboats, several torpedo-boats, and a number of steamers.

PLATA, Rio de la. From the Andes and the mountains of Brazil rivers of great magnitude descend, and meeting together pour their united waters into the ocean through a common outlet. This outlet is the river La Plata, which is in reality not a river so much as an estuary receiving great rivers. At its mouth, between Cape St. Antonio and Cape St. Mary, it has a width of 170 miles. About 50 miles higher up, near Monte Video, where it is reduced to a width of 53 miles, its waters are already quite fresh. At Buenos Ayres, 150 miles farther up, the land, being low, is not visible from the middle of the stream. The junction of the tributary rivers which forms the commencement of the La Plata takes place 30 to 40 miles above Buenos Ayres. The current of this great river is perceptible in the Atlantic at a distance of 100 miles, or even 200 miles; yet the depth of the stream is by no means proportional to its breadth. Above Monte Video its navigable channels are narrowed by sand-banks, and so shallow are its southern shores that at Buenos Ayres vessels of moderate size are obliged to anchor 6 to 9 miles from land. Even boats cannot run fairly on shore, but are obliged to transfer their passengers to rudely-constructed, large-wheeled carts, which convey them over some hundred yards of shallow water. The great rivers which unite to form the La Plata are the Paraná and Uruguay (which see). Monte Video and Buenos Ayres are almost the only ports of the La Plata visited by foreign ships.

PLATÆA, a town in Bœotia, celebrated for the battle in which the Persians, under Mardonius, were defeated by the Greeks, B.C. 479. After Xerxes had been defeated at Salamis he returned with the greater part of his forces, but left 300,000 men under Mardonius in Thessaly to influence the negotiations of that commander with the Greeks. On the failure of his attempts to negotiate Mardonius advanced towards Attica, and laid waste everything with fire and sword. One hundred thousand Greeks under Pausanias and Aristides, having solemnly sworn to prefer death to subjugation, advanced against the Persians, and the two armies met near the small town of Platæa, September 25. The loss of the Greeks was inconsiderable. Mardonius fell, and hardly one tenth part of his army escaped by flight; but few ever returned to their country. On the same day the remnant of the Persian fleet, which had escaped from Salamis, was destroyed off Mycale by the Greeks under the Athenian Xanthippus and the Spartan Leotychides. From that time Greece was freed from invasions from Persia. The Platæans distinguished themselves both at Marathon and Platæa. In the Peloponnesian war Platæa sided with Athens, and was besieged in B.C. 429 by a Theban and Lacedæmonian force. The siege lasted for two years, when at last the garrison were compelled from hunger to surrender. They were put to the sword and their city destroyed. It was rebuilt in accordance with the terms of the Peace of Antalcidas (387), but the inhabitants were soon after driven out by the Thebans, and the town was not finally reoccupied till after the battle of Chæronea.

PLATANISTA, a curious genus belonging to the order of Cetacea or Whales, and usually included in the family of the Delphinidæ or Dolphins. This genus includes a single species only (*P. Gangetica*), which inhabits the estuary of the Ganges. It is distinguished by the greatly elongated muzzle, by the small size and rudimentary nature of the eyes, and by the blow-holes or nostrils existing in the form of a longitudinal groove or fissure. This form differs thus in many structural points from the ordinary Dolphins, and also differs from the other members of its family in being an inhabitant of fresh waters. Its average length is about 7 feet. An allied form (*Inia Boliviensis*) similarly inhabits the rivers of Bolivia, and is thus found at distances sometimes exceeding 2000 miles from the sea. Numerous small teeth exist in both jaws of the Platanistidæ.

PLATE-GLASS. See Glass.

PLATE-MARKS. Gold and silver plate is legally stamped as being of a certain degree of fineness at the Goldsmiths' Hall, London, the assay offices in Edinburgh and Dublin, and several provincial offices, as in Birmingham and Sheffield. The process usually adopted is that after the article is made and stamped with the maker's name or mark, it is sent to the Goldsmiths' Hall or other assay office, where a few fragments are scraped off for the purpose of assaying. If they do not come up to the standard the article is broken up; if they do, it is stamped and returned. The assay-office receives a fee for assaying, and also collects the government duty on the plate. In the provincial offices the portion of the material taken for assaying is divided into two parts, one of which is assayed, the other put into a receptacle called the diet-box, which is sent up annually to the royal mint in London. The master of the mint assays some of the fragments, and if they are found deficient the assay-office is fined; if satisfactory, it receives a certificate.

The fineness of gold is expressed in carats. The carat is a weight of 4 grains, and the supposed unit of quantity to which the analysis referred is 24 carats; thus when gold is said to be 18 carats fine it is meant that eighteen out of every twenty-four parts consist of fine gold, and six of alloy. The fineness of silver is similarly denoted by the number of ounces and pennyweights fine in 1 lb. The degree of fineness is now frequently expressed in 1000th parts, as in France. Until 1854, 22 and 18 carats were the only standards of gold legally stamped, but to meet foreign competition gold has since then been allowed to be stamped of 15, 12, and 9 carats. The standards for silver are 11 oz. 2 dwts. and 11 oz. 10 dwts.; the latter, called new sterling, is seldom used.

The standard mark for plate of the fineness of coin is in England a lion passant, in Scotland a thistle, in Ireland a harp crowned; but in England, since 1844, gold of 22 and 18 carats are distinguished by a crown followed by the number of carats; 15, 12, and 9 carats bear only the numbers denoting their fineness in carats and milliemes; silver of 11 oz. 10 dwts. has a Britannia. All stamped articles bear also the maker's mark or initials; a date mark, which is in the form of a variable letter; the hall mark, or distinctive mark of the assay-office, that of the Goldsmiths' Company being a leopard's head crowned, of Birmingham an anchor, of Sheffield a crown, of Edinburgh a castle, of Dublin a Hibernia; and the duty mark, which is the sovereign's head. The date-letter of the Goldsmiths' Company began in May, 1716, with A, in Roman capitals; the cycle consists of twenty letters, omitting J and ending with U. Small Roman was used for the second cycle, Old English for the third, small Roman for the fourth, Roman capitals for the fifth, Roman small letters for the sixth, Old English capitals for the seventh, Old

English small letters for the eighth, and Roman letters (capitals) for the ninth ending in 1895–96.

PLATE-POWDER. Red oxide of iron, called jewellers' rouge, is the best powder for cleaning gold; for silver prepared chalk of the best quality should be used. The powder may be applied with a plate-brush, and chamois-leather or soft woollen rags used in cleaning up the plate. Mercurial plate-powder is injurious.

PLATING. For the process of plating with the precious metals now in most general use see ELECTRO-PLATING. The method which formerly prevailed, and which is still a good deal used, though declining under the influence of electro-plating, is called Sheffield-plating. The metal commonly used for plating with silver was at one time copper alone, or alloyed with brass; but German silver or some white metal alloy is now generally used, as it does not discolour the plate where the coating of silver becomes thin. Gold is generally plated on silver. In Sheffield-plating the superior metal is laid on an ingot of the inferior, one or both sides of which may be covered with it of the required thickness. When the surfaces have been carefully prepared the silver plate is coated with a strong solution of borax and applied to the ingot. They are then firmly bound with iron-wire, and subjected to a strong heat in a plating-furnace. When the fusing-point is almost reached the act of soldering takes place, and they are immediately removed from the furnace. The plate is afterwards brought to the required thickness in a rolling-mill, the silver and the alloy maintaining the same proportionate thickness throughout. Ornamental borders and mouldings are made separately of thin silver, and filled with lead.

PLATINUM is a metal of modern discovery, and owes its name to the idea at first entertained of its being related to silver, it being a diminutive of the Spanish word *plata*. We shall first describe its ore, denominated in mineralogy *native platinum*. It occurs in very small, irregularly formed grains, of uneven surface, usually flattened, and having the appearance of being worn by attrition. They are destitute of cleavage, and possessed of a hackly fracture; lustre metallic; colour perfect steel-gray; streak unchanged and shining; ductile; hardness a little above that of fluor-spar; specific gravity 17·3. It generally contains a little iron, and is accompanied besides by iridium, osmium, rhodium, palladium, ruthenium, and also sometimes by copper, chromium, and titanium. It is very refractory, and soluble only in nitro-muriatic acid. The pieces in which it occurs rarely exceed a few grains in weight. It has been found principally in secondary deposits, and was first brought from Peru, and from Choco in New Grenada. It also occurs in Brazil and St. Domingo; but it now comes in the largest quantity from Siberia, where it is found in the auriferous sands of Kuschwa, in the Uralian Mountains. The richest beds of these sands are from 2½ to 5 feet in thickness, and yield from 1 to 3 lbs. of metal for about 3700 lbs. of sand. Native platinum is also abundant on the western slope of the Uralian Mountains. More recently it has been found in a sienitic rock, along with oxide of iron and gold. The grains in which it occurred possessed the same shape as those found in the sands. This locality is near Santa Rosa, in the province of Antioquia in New Grenada.

The methods employed for obtaining the pure metal from its ore are two, namely, the method of Wollaston and the method of Debray and Deville. According to the former method the crude platinum is dissolved in aqua regia. The acid should be allowed to digest three or four days, with a heat which ought gradually to be raised. The solution, being then poured off, should be suffered to stand until a quantity of fine pulverulent ore of iridium, suspended in the liquid, has completely subsided, and should then be mixed with a solution of chloride of ammonium (the salt being dissolved in five times its weight of water). A yellow precipitate of the double chloride of ammonium and platinum will immediately fall, which must be well washed in order to free it from the various impurities known to exist in native platinum, and must ultimately be well pressed in order to remove the last remnant of the washings. It is next to be heated with the utmost caution in a black lead pot, with so low a heat as just to expel the whole of the chloride of ammonium, and to occasion the particles of platinum to cohere as little as possible; for on this depends the ultimate ductility of the product. When turned out of the crucible it will be found of a gray colour, and if prepared with due precaution, lightly coherent. It now requires to be rubbed between the hands, in order to procure, by the gentlest means, as much as can possibly be so obtained of metallic powder, so fine as to pass through a fine lawn sieve. The coarser parts are then to be ground in a wooden bowl with a wooden pestle, but on no account with any harder material, capable of burnishing the particles of platinum (because burnished particles of platinum will not weld); and, indeed, every degree of burnishing would prevent the particles from cohering in the further stages of the process. And since platinum cannot be fused at any ordinary furnace heat, and consequently cannot be freed like other metals from its impurities during igneous fusion by fluxes, nor be rendered homogeneous by liquefaction, mechanical diffusion through water should here be made to answer, as far as may be, the purposes of melting, in allowing earthy matters to come to the surface by their lightness, and in making the solvent powers of water effect, as far as possible, the purifying powers of borax and other fluxes, in removing soluble oxides. By repeated washing, shaking, and decanting, the finer parts of the gray powder of platinum may be obtained as pure as other metals are rendered by the various processes of metallurgy; and if now poured over, and allowed to subside in a clean basin, a uniform mud or pulp will be obtained, ready for the further process of casting. The mould to be used for casting the metallic powder is a brass barrel, 6¾ inches long, turned rather taper within, with a view to facilitate the extraction of the ingot to be formed, being 1·12 inch in diameter at top, and 1·23 inch at ¼ inch from the bottom, and plugged at its larger extremity with a stopper of steel, that enters the barrel to the depth of ¼ inch. The inside of the mould being now well greased with a little lard, and the stopper being fitted tight into the barrel by surrounding it with blotting paper (for the paper facilitates the extraction of the stopper, and allows the escape of water during compression), the barrel is to be set upright in a jug of water, and is itself to be filled with that fluid. It is next to be filled quite full with the mud of platinum, which, subsiding to the bottom of the water, is sure to fill the barrel without cavities, and with uniformity—a uniformity to be rendered perfect by subsequent pressure. In order, however, to guard effectually against cavities, the barrel may be weighed after filling it, and the actual weight of its contents being thus ascertained may be compared with that weight of platinum and water which it is known by estimate that the barrel ought to contain. A circular piece of soft paper first, and then of woollen cloth, being laid upon the surface of the barrel, allow the water to pass during partial compression by the force of the hand with a wooden plug. A circular plate of copper is then placed upon the top, and thus sufficient

consistency is given to the contents to allow of the barrel being laid horizontally in a forcing press. After compression, which is to be carried to the utmost limits, the stopper at the extremity being taken out, the cake of platinum will easily be removed owing to the conical form of the barrel; and being now so hard and firm that it may be handled without danger of breaking, it is to be placed upon a charcoal fire, and there heated to redness, in order to drive off moisture, burn off grease, and give to it a firmer degree of cohesion. The cake is next to be heated in a wind-furnace, and for this purpose it is to be raised upon an earthen stand, about 2½ inches above the grate of the furnace, the stand being strewn over with a layer of clean quartzose sand, on which the cake is to be placed, standing upright on one of its ends. It is then to be covered with an inverted cylindrical pot of the most refractory crucible ware, resting at its open end on the layer of sand, and care is to be taken that the sides of the pot do not touch the cake. To prevent the blistering of the platinum by heat, which is the usual defect of this metal in its unmanufactured state, it is essential to expose the cake to the most intense heat that a wind-furnace can be made to receive, more intense than the platinum can well be required to bear under any subsequent treatment, so that all impurities may be totally driven off. The furnace is fed with coke, and the action of the fire maintained for about twenty minutes from the time of lighting it. The cake is now to be removed from the furnace, and being placed upright upon an anvil, is to be struck, while hot, upon the top, with a heavy hammer, so as at one beating effectually to close the metal. If in this process the cylinder should become bent it must on no account be hammered on the side, by which treatment it would be cracked immediately, but must be straitened by blows given upon the extremities, dexterously directed, so as to reduce to a straight line the parts that project. The ingot of platinum when cold may be reduced by the processes of heating and forging, like any other metal, to any form that may be required. After forging, the ingot is to be cleaned from the ferruginous scales which its surface is apt to contract in the fire, by smearing over its surface with a moistened mixture of equal parts, by measure, of crystallized borax and common salt of tartar, which, when in fusion, is a ready solvent of such impurities, while it does not act, like caustic potash, upon the platinum itself. It is then to be exposed upon a platinum tray, under an inverted pot, to the heat of a wind-furnace. The ingot may then be flattened into leaf, drawn into wire, or submitted to any of the processes of which the most ductile metals are capable. The mean specific gravity of the metallic cake of platinum powder, when taken from the press, is 10; that of the cake fully contracted by heat, before forging, is from 17 to 17·7; that after forging is about 21·25; and that of wire 21·5, being the maximum density of this metal.

The process of Deville and Debray differs entirely from that just described. It consists in forming an easily fusible alloy of lead and platinum, and then removing the lead by cupellation. The platinum ore, mixed with an equal weight of galena, is introduced into a small reverbatory furnace, where it is strongly heated, litharge being added from time to time. The sulphur of the galena is gradually expelled, while the reduced lead unites with the platinum to form an alloy which is liquid at the temperature of the furnace. The foreign metals sink to the bottom of the furnace. The liquid alloy is now removed and submitted to the process of cupellation in the ordinary way, whereby the lead is removed. The crude platinum is now refined by fusion at the temperature of the oxyhydrogen flame. For this purpose the metal is placed in a crucible made of well-burned lime, and the nozzle of the blowpipe is arranged so that the flame shall play around this crucible. By this means the metal is quickly melted, in which state it may be cast into ingots.

Pure platinum has a white colour, very much like that of silver, but it is inferior in lustre to that metal. Its malleability is far less than that of gold or silver, but superior to that of tin. It may be drawn into wires not thicker than the 2000th part of an inch. It is a soft metal, and, like iron, admits of being welded at a high temperature. A wire one-tenth of an inch supports 590 lbs. without breaking. As a conductor of heat it ranks between gold and silver. It undergoes no change from the combined agency of air and moisture, and it may be exposed to the strongest heat of a smith's forge without suffering either oxidation or fusion. On heating a small wire of it by means of galvanism or the oxyhydrogen blowpipe, it is fused, and afterwards burns with the emission of sparks. Platinum is not attacked by any of the pure acids. Its only solvents are chlorine and nitro-muriatic acid, which act upon it with greater difficulty than on gold. The resulting orange-red coloured liquid, from which the excess of acid should be expelled by cautious evaporation, contains tetrachloride of platinum. Platinum in a finely divided state has the power of absorbing and condensing large quantities of gases. By taking advantage of this fact chemical action may sometimes be brought about between gases which, under ordinary circumstances, do not react upon each other. Thus if a mixture of oxygen and sulphur-dioxide be passed over heated spongy platinum, as the finely divided metal is called, they unite to form sulphur trioxide. So if a jet of hydrogen be allowed to impinge upon spongy platinum it is soon ignited, because the platinum has absorbed and condensed on its own surface a large amount of atmospheric oxygen, with which the hydrogen is brought into such close contact that combination takes place.

On account of its great infusibility, and its power generally of withstanding the action of chemical reagents, platinum is much used as a material for making vessels to be used in the chemical laboratory. Crucibles, evaporating dishes, &c., are very often made of platinum; so also the large stills used for the evaporation of sulphuric acid (which see) are made of this metal. Although unacted upon by so many chemical reagents, platinum vessels must nevertheless be used with care. Easily reducible oxides, such as oxide of lead, must not be heated in these vessels, neither must they be exposed to the action of moist chlorine, of hot caustic potash, of aqua regia, &c.

The useful alloys of platinum are not numerous. With silver it forms a tolerably fusible white alloy, malleable and brilliant when polished; but it scales and blackens by working. Gold, by a forge heat, combines with platinum, and the alloys, in all proportions, are more fusible than the latter metal. In the proportion of 38 grs. to 1 oz. it forms a yellowish white, ductile, hard alloy; it is so elastic after hammering that it has been proposed to use it for watch-springs. Mercury, by trituration with spongy platinum, forms an amalgam at first soft, but which soon becomes firm, and has been much used in obtaining malleable platinum. A coating of platinum can be given to copper and other metals by applying to them an amalgam of spongy platinum, and 5 parts of mercury; the latter metal is then volatilized by heat. Lead combines with platinum readily; and iron and copper in like manner; the last mentioned, when added in the proportion of 7 to 16 of platinum and 1 of zinc, and fused in a crucible under charcoal

powder, forms the alloy called artificial gold. Steel unites with platinum in all proportions, and especially in the proportion of from 1 to 3 per cent. of platinum, forms a tough and tenacious alloy, well adapted for cutting instruments. Arsenic unites easily with platinum, and was once employed for rendering the latter metal fusible. An alloy of platinum, iridium, and rhodium is used for making crucibles, &c. It is harder than pure platinum, is less easily attacked by chemical reagents, and bears a higher temperature without fusing.

Platinum forms two chlorides, *platinous chloride*, $PtCl_2$, and *platinic chloride*, $PtCl_4$. The latter is often used in the laboratory as a test for potassium salts; it is produced by dissolving the metal in aqua regia, and removing the nitric acid by repeated evaporation with hydrochloric acid. The oxides of platinum are likewise two in number, *platinous oxide*, PtO, and *platinic oxide*, PtO_2. This metal forms a very interesting series of so-called *platin-ammonia compounds*, in which varying amounts of ammonia are united with either a platinous or platinic salt; thus we have *diammonio-platinous chloride*, $2NH_3 . PtCl_2$; *diammonio-platinic chloride*, $2NH_3 . PtCl_4$; and so on.

PLATO, the disciple of Socrates, and founder of one of the great schools of Greek philosophy. It was during the political decline of Athens, in the period of Spartan and Theban ascendency, and of the rise of the Macedonian power, that Plato flourished. The few particulars of his life which have been preserved are involved in considerable obscurity and uncertainty, while the scope they afford for amplification, as well as the great interest attaching to them, has led to many apocryphal additions being made to them, whether in the form of inference or of pure invention. He was, as is supposed, the son of Ariston and Perictione, and was born at Athens or in the Island of Ægina, probably on 27th May, B.C. 430 or 427. He was originally named Aristocles, after his grandfather. His father claimed descent from Codrus, his mother from a relative of Solon. His maternal uncles Critias and Charmides were disciples and companions of Socrates. Plato appears to have been instructed in the principal sciences of the day, particularly grammar, music, and gymnastics, by the best masters. The names of several of his instructors are given, but not all on unquestioned authority. Aristo of Argos, his teacher of gymnastics, is said to have given him the name of Plato on account of the breadth of his shoulders. There are other accounts of the origin of this name. In his youth he is said to have contended in the Isthmian and other games, and to have made attempts in epic, lyric, and dithyrambic poetry. He is also supposed to have served in some campaigns, and by law he would be liable to military service at the age of eighteen. Before becoming acquainted with Socrates he appears to have been instructed in the doctrines of Heraclitus by Cratylus, and he was probably not unacquainted with other current systems of philosophy. It was by common accounts in his twentieth year that he came directly under the influence of Socrates, and from this time he gave himself entirely to philosophy, destroying, it is said, his early poetical compositions. Until the death of Socrates (B.C. 399) he appears to have been his constant and favourite pupil. There are indeed no precise accounts of his intercourse with Socrates, but his own writings afford the best evidence of its intimacy. The death of Socrates forms the second turning-point in the life of Plato. Plato was present at the trial, and offered to guarantee any fine to which Socrates might be subjected. He is said to have attempted to speak, but to have been put down by the judges. He was absent from illness on the day of Socrates' death, and did not hear his last conversations. After the death of Socrates Plato left Athens, betaking himself first with other disciples of Socrates to Euclid at Megara. Whether he returned to Athens before his subsequent journeys is uncertain. Friendship for Theodorus, or the desire to perfect himself in mathematics, led him to Cyrene, where he spent some time in studying mathematics under Theodorus. He then visited Egypt, where he studied astronomy; perhaps Asia Minor; the Greek cities of Lower Italy, apparently to acquaint himself with the doctrine and social organization of the Pythagoreans; and Sicily. The order and purpose of these journeys are differently related; some of them are questioned altogether. While some have attributed to him a design, in itself highly probable, to make himself acquainted with all the learning of his day by personal visits to its chief seats, and have without evidence extended his tour by supposed visits to the Hebrews, Babylonians, Assyrians, Persians, &c., from the knowledge of their institutions contained in his works, others have failed to find in these any distinct traces of information acquired even in his authentic journeys which might not have been attained at Athens. His first visit to Sicily took place when he was about forty years of age. He converted Dion, the brother-in-law of Dionysius the Elder, to his views; but Dionysius, according to the common reports, resented his admonitions, treated him as a prisoner of war, and sold him to the Spartan ambassador Pollis, from whom he was rescued by the Cyrenian Anniceris. This story is of doubtful authenticity. About B.C. 389 or 388 Plato returned to Athens, and began to teach in the gymnasium of the Academy, situated outside the city in a north-westerly direction, and about 6 or 8 stadia from the Dipylum Gate, and in his own garden at Colonus, in the immediate neighbourhood. He appears to have had a patrimony sufficient for his wants, and taught without remuneration. The inner circle of his disciples, who numbered about twenty-eight, assembled at simple meals in his garden. Plato's teaching was interrupted by two visits to Syracuse, the first on the accession of Dionysius II., in order to instruct him in philosophy; the second in B.C. 361, to reconcile Dion with Dionysius. His efforts on both occasions were unsuccessful, and on the latter he owed his own safety only to the earnest intercession of Archytas. During his absence his place was supplied by one of his more intimate pupils, of whom Heraclides Ponticus is named. With this exception the whole of the remainder of his life was spent at Athens in giving instruction and composing his works. He died B.C. 347, in the eighty-first or eighty-fourth year of his age. By his will his garden remained the property of his school. He is said to have died while writing; by others at a marriage feast.

Plato was in personal appearance distinguished by manly beauty. His mind was endowed with the highest qualities. To a creative imagination of the first order he added logical, analytical, and constructive powers of equal eminence. Above all he was penetrated with the conviction of a harmony in the universe of being which led to the conception of a high ideal of life, and supplied him with the strength of purpose consistently to maintain it. This he probably owed to his connection with Socrates; and towards the close of his life he is said to have declared it a happy dispensation for him which had made him a contemporary of Socrates. One of the finest traits in the character of Plato was his unswerving devotion to his great teacher. After the death of Socrates the elder philosopher assumed a kind of sacred and ideal character as the personification of philosophical wisdom in the teaching of his disciple. The whole

of the writings of Plato, which are in the form of dialogue, are dominated by this character. Socrates plays the chief part throughout, while he himself is only once or twice mentioned. It is thus often a matter of difficulty to distinguish between the original teaching of Socrates and the corrections or developments of Plato. As far as Plato himself is concerned, it is by no means necessary that this should be done. As he has chosen to identify himself with the teaching of his master, it would serve little purpose to draw a distinction which he has not himself cared to make. It may, however, be observed generally that that for which Plato seems chiefly indebted to Socrates is the central ethical purpose which distinguishes alike the doctrine of both philosophers, and that the bolder speculations and more daring metaphysical developments of the joint system are his own.

The works of Plato, which were only supplementary to his oral teaching, have, by the dutiful care of his disciples, been preserved intact. This has not prevented their admixture with some of the works of his earlier disciples, and even of some of a considerably later date, which has rendered the work of identification one of some difficulty, and has led to considerable difference of opinion in regard to some treatises. Those works which have been mentioned by Aristotle are generally considered as the best attested, but this is not always regarded by critics. The reputed works of Plato consist of Dialogues and Letters. The latter are generally regarded as spurious, though some of them were probably composed by immediate disciples of Plato. The order of composition of the Dialogues is also a matter of much importance and of great difficulty. Aristophanes of Byzantium arranged them in trilogies; Thrasyllus, the neo-Pythagorean, in the time of the Emperor Tiberius, in nine tetralogies, as follows: 1, Euthyphron, Apologia, Crito, Phædo; 2, Cratylus, Theætetus, Sophistes, Politicus; 3, Parmenides, Philebus, Convivium (Banquet), Phædrus; 4, Alcibiades 1 and 2, Hipparchus, and Anterastæ; 5, Theages, Charmides, Laches, Lysis; 6, Euthydemus, Protagoras, Gorgias, Meno; 7, Hippias major and minor, Io, Menexenus; 8, Clitophon, Republic, Timæus, Critias; 9, Minos, Leges (Laws), Epinomis, Epistolæ (Letters). The first attempt at a more critical arrangement was made by Schleiermacher, who adopted a didactic arrangement into three divisions, in the first of which Plato's special doctrine of ideas is contained in germ; in the second the difference between the common and philosophical conception of things is dialectically treated; in the third the practical doctrines of his philosophy are developed and completed. Brandis, who substantially agrees with Schleiermacher, observes that this arrangement does not necessarily imply a chronological order or a plan completely developed in advance in all its details. It is sufficient that Plato should have conceived the leading points of his system before adopting such a method of developing it, and he might at any time enrich any part of his plan with fresh discussions adapted to the degree of development attained in it. The leading works in Schleiermacher's first section are Phædrus, Protagoras, Parmenides; in the second, Theætetus, Sophistes, Politicus, Phædo, and Philebus; in the third, the Republic, Timæus, and Critias as principal, and the Leges as adjunct. Hermann has attempted to make out a chronological arrangement, and other scholars who differ from Schleiermacher have attempted various theories of constructive arrangement. These schemes in general proceed on the assumption that each dialogue, besides being an artistic whole, forms a link in a chain. This is denied by Grote, who does not admit that Plato followed any plan either artistic or didactic. Each dialogue, according to him, represents the state of Plato's mind at the time it was composed, and it is not necessary to suppose that in writing the dialogues of research and inquiry Plato was already in possession of the solution contained in the constructive dialogues. The disturbing of prejudices and pointing out of difficulties has itself a value, and the dialogues of research present an end in themselves. The last observation is true, but Grote's application of it seems to do scanty justice both to Plato and his commentators, and to justify the complaint that Grote has treated Plato from the point of view of a historian rather than of a philosopher. The evidences of dialectic skill in preparing the mind of the inquirer by the difficulties contained in the earlier dialogues for the solutions presented in the later on this hypothesis go for nothing. The students of Plato are not prepared to reject these evidences, and it is clearly one thing to say that Plato's plan has not been discovered, and another to say that he had none. Susemihl adopts the intermediate view that Plato had a definite plan, but that it was only fully developed as he progressed.

In regard to the genuineness of the Dialogues attributed to Plato, the greater number of them is generally admitted, and all or nearly all of the disputed ones have some suffrages. The Parmenides, Sophistes, and Politicus are disputed by Socher; the Menon by Ast; the Leges by Zeller. These are defended by Hermann. Schleiermacher questions the Minor Hippias, the Ion, and the Menexenus, though admitted by Aristotle. The Demodocus, Sisyphus, Eryxias, Axiochus, were anciently regarded as spurious, and with them Brandis classes the Hipparchus, Theages, and Definitions. The spuriousness of all the letters is commonly regarded as demonstrated. Grote accepts as genuine all that was admitted as such by Thrasyllus.

The time when Plato began to compose his Dialogues is uncertain. Some attribute the composition of the earliest class to a period anterior to the death of Socrates; others, having regard to the idealization of the character of Socrates which pervades them all, hold their commencement to be subsequent to that event. On this view the Apologia is regarded as one of the earliest, and it is generally allowed to contain a historical and substantially faithful account of the defence of Socrates. Ueberweg supposes that Plato began to write his Dialogues about the time of the opening of the Academy, and that, omitting minor dialogues, they were probably written in the following order:—Phædrus, Banquet, Protagoras, Gorgias, Meno, Republic, Timæus, Critias, Phædo, Cratylus, Theætetus, Philebus, Leges; the Apologia he considers to be early and faithful.

The philosophy of Plato, whether considered in itself or in connection with the circumstances in which it arose, must be regarded as one of the greatest and noblest efforts ever made by the human mind to compass the problem of life. An important element in the examination of it is the method of Plato's teaching. As this was nearly the opposite of what is commonly considered essential in modern method, unless it is fully realized great injustice is certain to be done to his treatment of the various problems he discusses.

After the example of Socrates, Plato held the great end of philosophic teaching to be to lead the mind of the inquirer to the discovery of truth rather than to impart it dogmatically, and for this end he held oral teaching to be superior to writing, not merely as in modern practice for enlarging upon and explaining a written text, but in the direct pursuit of philosophical investigation. This preference

appears to have determined the form of his works, and that form is justified by his unrivalled skill in the management of the philosophic dialogue, to which he imparts the charms of poetry and dramatic representation. In the Phædrus he says 'every writing resolves itself in effect into a means of recollection for him who already knows: if questioned it does not answer; if attacked it cannot defend itself. Any discourse traced by the hand is therefore a work of comparatively little weight—an imperfect recollection mingled with frivolity. The only legitimate and fertile child of thought is a discourse on the just and the beautiful written on the soul.'

The question here is not as to the comparative advantages and inconveniences of such a mode of instruction, but as to the effect it has had on Plato's writings, and consequently on what is known of his system. One thing, however, appears evident, that the teachers are few who could dare to trust themselves to such a method. Plato's oral teaching, like his writings, appears to have been chiefly conversational. He was distinguished by fluency of speech to a degree which has suggested this quality as one of the explanations of his name. But it is also on record that he sometimes delivered formal discourses or orations. Themistius mentions his delivering a lecture on the Good in the Piræus before an audience which gradually dwindled away. Aristotle has preserved a fragment of a lecture on this subject.

Plato has acted undesignedly as the historian of earlier Greek philosophy. His writings contain lively and accurate accounts of previous systems and their teachers, introduced not merely for historical purposes, but incidentally to the analysis of their opinions in the search of truth. He also freely analyzed the poets, and he censured the best of them for want of clear ideas and true insight. Homer and Hesiod are excluded from his republic. The imaginative element entered largely into Plato's own teaching. He made use of myths as a means of facilitating the apprehension of his doctrines; but the instrument which he held alone adequate to the attainment of philosophical cognition was the method of dialectic, which he may be said to have been the first to employ scientifically in philosophy. In discoursing on this method he vividly recalls the dramatic representations of wisdom in the Proverbs of Solomon. Wisdom is the attribute of the Godhead; the love of wisdom, the distinction of the intellectual man, and the greatest good to which he can attain. When we strive after wisdom with the intensity of a lover she becomes the true consecration and purification of the soul. This aspiration implies an original relation of the soul to the source of true being, and its development he terms dialectics. The partial solutions of the problem of human knowledge which had been given by the earlier systems of Greek philosophy ended in paradoxical and contradictory conclusions, which had produced the scepticism of the Sophists. Socrates combated these on ethical grounds. Plato took up the contention, and carried the war, as it were, into the enemy's camp, by attempting anew on broader grounds, and by a surer method, the search into the foundations of knowledge. His dialectic had to clear its way between the sensualism of Protagoras, whose doctrine of eternal generation made all things subject to incessant change, and left no real existence of which there could be any knowledge, and no permanent possibility of knowledge itself, and the Eleatic doctrine of the unconditional unity of existence, which made all change merely phenomenal and non-existent. Plato combated these hypothetical systems by a strict analysis of knowledge, of which he distinguished the subjective and objective elements. He also originated the distinction of philosophy into the three branches of ethics, physics, and dialectics, although these names were first applied by his disciple Xenocrates.

The cardinal principle of Plato's dialectical system is the doctrine of ideas, and unfortunately his method of developing his principles has left some room for doubt or misunderstanding as to what this doctrine really was. Differences upon the subject began early, and different opinions are still expressed by critics. It does not appear, however, that the means of solution are actually wanting. This doctrine so pervades the entire system of Plato—dialectics, ethics, and physics, of all of which it is the fertilizing or creative principle, that if we give a due attention to its place in each we can hardly miss a substantially accurate conception of it. We do not, indeed, mean to say Plato has succeeded in developing his doctrine with perfect consistency and completeness, or that by means of it he has been able to erect a perfectly harmonious, uniform, and interdependent system of ethics, physics, and dialectics. It was much to attempt this, and the attempt has clearly been made. Notwithstanding the very different conditions of ancient and modern philosophy, the want of a directly systematic exposition, and the veil of allegory with which, like a still greater teacher, he has surrounded his doctrine, it has been made with a distinctness which can be traced even now. From a comparison of various statements which Plato has made respecting ideas, a theory of them may be traced in relation to the various parts of his system, more coherent perhaps than a hostile criticism, which insists on a literal interpretation of every passage, would be willing to allow; but which, if it contains nothing but what Plato actually taught, may, as an outline of his doctrine, be more just and adequate than any partial views of it however literally expressed.

Respecting the historical origin of the doctrine of ideas Aristotle has left an interesting statement, which renders it probable that it was during the lifetime of Socrates that it was first conceived. Plato, he says, derived from Cratylus, the Heraclitean, the doctrine that the sensuous is subject to perpetual change. This he ever afterwards maintained, and when he learned from Socrates of conceptions, which, when once rightly defined, remain for ever invariable, he believed that their counterparts must not be sought in the sensuous world; but that there must be other existences which were the objects of conceptual cognition, and these objects he named ideas. Euclid of Megara has also been credited with exercising a considerable influence on the development of his views.

The philosophical genesis of the doctrine of ideas is not uncertain. It was in the human mind and in the analysis of its conceptions that Plato found it. The word had been used before his time, and has been used since to signify the mental image by which an object of sense is reproduced in the mind. This is not Plato's idea. Such an image is merely the concrete conception, Plato's idea is derived from an analysis of conception. It represents, as indicated in the passage in Aristotle above referred to, the immutable element in conception. Here, however, a misunderstanding is apt to arise from the terms employed in modern philosophy. It is common now to analyze conception or cognition into two elements, the universal or invariable, and the particular or variable; the former is the *ego* or subject considered apart from the matter or object of cognition. This distinction is not that of the Platonic analysis. It is not the relation of the mind to the conception, but the particular conception itself, whether in or out of the mind, that is the subject of it. In this conception, in each such conception, Plato finds an immu-

table element which he calls its idea. This he illustrates in many ways, and in regard to a great variety of subjects. That which forms, perhaps, the basis on which the Platonic structure has been reared, and which best serves to illustrate its distinctive principle, is the case of opposite or contrasted conceptions. In the statement that Simmias is large in comparison with Socrates, but small in comparison with Phaedo, we appear to view largeness and smallness as purely relative conceptions, since in the one case we predicate the one and in the other case the other of the same individual. But when we subject these conceptions to the scrutiny of reason we find that they cannot be wholly relative. The comparative implies the positive, for unless there were something absolute and immutable in the conception of largeness it could not be compared with smallness or anything else. If the conception were transient in the individual mind the comparison would be transient also, and an object which was conceived of at one time as relatively large in comparison with another, might be conceived of at another as relatively small in comparison with the same object; or if the conception varied in different minds the ground of the comparison would vary in like manner. But largeness is always conceived of as bearing the same relation to smallness, and we mean the same thing in the above comparison when we say that Simmias is larger that Socrates, as when we say that Phaedo is larger than Simmias. There must therefore be something positive in the conceptions both of largeness and smallness to allow of their being thus constantly opposed; but this cannot be the particular amount of largeness contained in Simmias, seeing he is large in the one case and small in the other. Hence Plato distinguishes between the concrete quality as conceived to exist in an object, and the idea of the quality. The former is mutable, the latter immutable; but the quality always partakes of the idea, otherwise it would cease to exist. It makes no difference to this analysis whether the qualities we analyze are simple or complex considered as qualities, that is to say, whether we can resolve them into other qualities or not. If we suppose in the instance we have taken that greatness and smallness are resolvable into the common quality or condition of size, combined with more or less, then the same observations apply to more or less, as have already been made in regard to greatness and smallness, and it is besides indispensable that in the comparison the conception more should be combined with size, and not with something else, otherwise we might as well compare greatness with death, and smallness with blackness, as with each other. Complex conceptions have thus their immutable conditions, as well as simple ones; but in the case of such conceptions the latitude for variations of the quality within the scope of the idea may be very great. The idea of a triangle may include numerous forms, but all these must comply with certain conditions, or they would not be triangles. In like manner the ideas of justice, virtue, beauty, are immutably distinguished, whether we regard them as simple ideas entering into numerous combinations, which they distinguish by a common quality, or as combinations admitting of a great variety of forms. When the word justice is commonly used, it is used in the belief that there is a common conception underlying it, and this is to a great extent unquestionably true; but if any one should use the term justice without the common underlying conception, he would merely be designating a conception with a different underlying idea by the same name, and if he got a number of people to agree with him a confusion would arise from the same name being applied to two different things. The case is precisely the same as if a heretical sect of mathematicians should set up the conception of a triangle with a break in the middle of one of its sides, making a triangular figure consisting of four lines, and not inclosing a space, and should persist in calling it a triangle.

This is the basis of the Platonic sphere of ideas, and some conception may already have been formed of its scope; but that conception would be inadequate if we omitted another fundamental condition of its development. If the question be asked, Where have we found these ideas? the answer undoubtedly is, In the human mind. They are there not in the form of concrete conceptions, but of necessary elements or conditions of these conceptions. Are they then purely subjective; is the necessity by which they arise a necessity which belongs to and inheres in the human mind alone? It is in handling this question that the greatness of Plato's conception of the mission of philosophy appears; it is in connection with it mainly that the obscurities which surround his exposition have arisen. Hitherto there is no essential difference between Plato and the modern school of idealists, between Plato, for example, and Kant; but the trouble is that Plato allegorizes his ideas: he gives them life and creative powers, he seats them on thrones in places beyond the vault of heaven; and in discussions more strictly dialectical he gives them an existence independent of time and space. Divested of the poetical surroundings, and with allowance made for the uncertainties and hesitation which may very well be allowed for in a philosophical investigation, both new in form and unparalleled in the vastness of its scope, the true dialectical development of Plato's views on this subject, we believe, amounts to nothing more than the assertion of the universal truth of ideas as the condition of intelligence. Plato's analysis does not stop short at human intelligence. He professes to analyze intelligence as such, and to show the conditions on which alone, whether finite or infinite, it is possible. Thus he asserts unhesitatingly the community of intelligence between God and man. That this is Plato's pretension may be gathered from various relative statements which he makes regarding ideas. While of ideas in themselves he predicates merely existence, through the activity of the Good he gives them causation according to their determinate natures; now of the Good itself, which is his highest idea, he says we can only imagine its activity as the activity of mind. But on what does this pretension rest? It cannot rest on anything higher than human knowledge; but in what manner it rests on human knowledge is worthy of attention. Whatever may be the limits of the sphere of human knowledge, we can conceive of knowledge beyond these limits. We cannot, of course, conceive in what such knowledge consists; but we can very well conceive of the possibility of its existence. We can also in some respects conceive of modes of knowledge different from those by which our knowledge is conditioned. We can conceive, for example, of the possibility of knowledge being communicated otherwise than by means of sensuous perceptions. Athough wholly destitute of experience in these matters, there is nothing in the constitution of our minds that compels us to confine knowledge to such subjects and forms as our own experience has accustomed us to; but it is different with regard to such conditions of knowledge as we have been considering. We find that the constitution of our minds is such, that not only have we no experience to imagine knowledge without such conditions, but that our minds utterly refuse to admit the possibility of it under any conceivable circumstances whatsoever. We can conceive of intelligences who shall not think

of triangles at all; but not of intelligences who shall think of triangles with four sides, or of which all the angles are not equal to two right angles. Now this particular condition of human intelligence is that by which the whole of our knowledge is regulated. It produces a harmony and order throughout the whole sphere of our intelligence. All the objects within that intelligence, as well the natural objects with which we are acquainted as the conceptions that arise in our minds regarding these objects, or our relations to them, submit to its sway, and readily enter into the harmony it produces, and all the efforts of science to extend our knowledge have left these conditions of it undisturbed. Now we must either regard these conditions as being universal laws of intelligence to which the human mind is compelled to submit merely as intelligent, or we must regard them as peculiar to the human mind. In the latter case the whole fabric of our knowledge falls into ruin, for if these are not universal conditions of knowledge we condition our knowledge absolutely by something which is merely arbitrary and peculiar to ourselves, it becomes then a mere illusion and a dream, and we are, to borrow the phrase of a modern philosopher, not originally applied to mankind, mere incarnate absurdities. But if these conditions of intelligence are universal, it follows that they cannot be created by any intelligence, for no intelligence can exist without them. They therefore exist necessarily, not in themselves, but in intelligence. When Pascal speaks of the laws of mathematics as being created by God, and Kant of the conditions of human knowledge as being purely subjective, they assert limits to which in neither case is our reason able to submit. The doctrine of Plato has nothing in common with these principles of modern idealism. It is allied, on the contrary, to the opposite school of realism. It asserts an objective side to the subjective itself, and a true knowledge of the constitution of our own minds, without which all other knowledge would be impossible. The most instructive comparison we can suggest for Plato's doctrine of ideas, is the foundation on which Sir William Hamilton places his philosophy, that of the veracity of consciousness. The first principle in both cases is virtually the same, but it is differently tested and developed. With Sir William Hamilton it is merely passive and dogmatic. Unless consciousness is believed we cannot philosophize. With Plato brought to the test of reason it becomes an active, vitalizing, and creative principle, which serves to extend philosophy to its utmost limits.

In strict logical development, indeed, Plato's doctrine would require to be carried further than he carried it. All the elements of conceptions would be found in strict analysis to be equally immutable, and the element of mutability would be found to consist only in their combinations; thus when any new conceptions appeared they would be due either to the introduction of new elements or of new combinations. The objective existence of matter too would be as strictly proved by the veracity of our conceptions as the objective existence of mind, for our conceptions of matter as matter are as immutable in themselves as our conceptions of mind as mind. As long as the same form of matter is presented to our conception our conception of it is the same; and if our conceptions of matter vary more than our conceptions of mind it is because the object of them varies more. There is then a varying object presented to our conceptions, and the variations of our conceptions correspond truly to the variations of the object. The cardinal principle of Plato's doctrine then is the fundamental unity of intelligence. There may be infinite diversities in degrees of intelligence and varieties in modes or media, but there can be no differences in kind of intelligence itself. In God or angel, man or beast, wherever it truly exists it is the same. God can give only what he possesses, and from the infinite Being down to the lowest organism which has the faintest flicker of intellectual light that light is one in substance. This logical extension of Plato's doctrine may be supposed to militate against Plato's argument for the immortality of the human soul, but it will injure it infinitely less than the drawing of an arbitrary line which annihilates the doctrine with all its consequences.

But if Plato failed to carry the logical development of his doctrine far enough down there was no want of boldness in an upward direction. Having discovered or created the realm of ideas he surveyed it throughout. He defined its most excellent forms as beauty, justice, and virtue, and having done so he determined what was the supreme and dominant principle of the whole. It is the idea of the Good. The harmony of intelligence throughout its entire extent with goodness, this is the highest attainment of Plato's philosophy. Beyond this it would be impossible to go; beyond this it would be impossible even to wish; for what could be conceived better than that infinite intelligence should correspond with goodness? It is with perfect consistency that Plato declares the idea of the Good to be superior to that of Being, for if goodness is the first condition of infinite intelligence it must comprehend Being as well as all other ideas which that intelligence contains. We do not, however, understand by Plato's idea of the Good the Deity himself, but only the abstract conception which comprehends the necessary condition of his existence. Plato, indeed, held the existence of an infinite intelligence whose highest attribute was goodness, and under whose government all things were ordered for good; but besides the necessity by the metaphysical process for reaching the abstraction before the reality there was a reason in the circumstances of his times why Plato should in his popular discourses dwell on the abstract idea rather than on the personal existence of God. There was no need to prove to an Athenian audience the existence of Deity. They had plenty of the personality of Deity; it was in the true conception of Deity they were wanting. Besides, Plato could not speak of a personal divinity different from those of the popular mythology without at once arousing enmity and opposition. The sphere of Deity was already occupied, that of abstraction was free. The circumstance already alluded to of Plato lecturing on the Good to a gradually diminishing audience—a picture in the history of philosophy worthy of the pencil of an artist—may be taken as an illustration of the practical relation of Plato's philosophy to the circumstances and wants of his time.

The ethical system of Plato was in direct dependence upon his dialectics, and will require little illustration. He believed that the ideas of all existing things were originally contained in God. These ideas were each the perfection of its kind, and as such were viewed by God with approval and love. God himself being infinitely good was the object of all imitation to intelligent beings, hence the ethics of Plato had a double foundation, the imitation of God and the realization of ideas, which were in each particular the models of perfection.

Plato's cosmical theories stood professedly on a different foundation from his dialectics and ethics. Matter did not come within the scope of his dialectical analysis. He had accepted a preconceived view of it which excluded it from dialectical treatment, consequently it had no place in his world of ideas, and no relation with God, upon whom they depended.

He consequently gave it an existence independent of God as a formless, passive, inert mass without qualities or conditions. To his cosmical theories he attributed only probability, holding that the dialectical method by which alone truth could be discovered was applicable only to ideas and the discovery of moral principles. The most valuable part of Plato's cosmogony is its first principle, that God, who is without envy, planned all things that they should be as nearly as possible like himself. He first made the soul of the world, which, being intermediate between the sensible and the intellectual, forms a connecting link between them. It is formed of two opposite principles, the one indivisible and immutable, the other mutable and divisible, and these are combined by an intermediate principle. To this soul he joined the material body. All things were created according to ideas, which were the perfection of each kind. Thus every individual in a species, for example, partakes of the idea of the species, but the individual is always inferior to the ideal. The soul of man, like the soul of the world, consists of three parts or elements. Plato attributes to it not only immortality but pre-existence. Sometimes this is predicated of the whole, sometimes only of the superior part. To the highest part of the soul, which has the head as its seat, he gives the cogitative powers and the desires appropriate to them; the intermediate part of the soul, having its seat in the heart, is distinguished by active impulses; the third part, with its seat in the bowels, by animal affections. Virtue, which is essentially one, has three distinct phases, corresponding to the threefold division of the soul. The virtue of the highest is wisdom, of the second courage, of the third temperance. The emotional part of the soul should govern the sensual and be under the government of the intellectual. Sexual love, separated from concupiscence, he regarded as a link between the sensual and the intellectual, and as consisting in an aspiration and perpetual striving after the immortal and eternal.

Plato's political treatises are the application of his ethical principles to social organization. In his Republic he does this without any regard to the practical, his object apparently being to sketch the ideal of a state which should serve as an abstract model of the things to be aimed at in social organization rather than to show how any particular object can be practically accomplished. The book of Laws is a sort of compromise between the speculative ideas of Plato and the actual state of society. He bases his Republic on the principle that the constitution of the state should correspond with that of the individual in order to allow the moral nature of the individual due scope for development. As he makes three parts of the soul, so he divides the state into three classes, the magisterial, the military, and the working, the last of which, like the sensuous part of the soul, is to be in complete subordination to the other two. The magisterial class is selected from among the middle class, the youth of which are to be carefully trained in science and virtue. The details are worked out into a multitude of arrangements, many of which are arbitrary, tyrannical, or impracticable. All art is excluded which does not consist in the imitation of the Good. Women receive the same education as men, and partake in their gymnastic exercises. Marriage and the intercourse of the sexes is the subject of very arbitrary and curious regulations. Of the three forms of government, monarchical, aristocratic, and democratic, he classes the first as best, the last as worst. The true king will always govern better than the law, for he will take account of particular cases and circumstances, but as his knowledge of these is limited the law is good as supplying particular principles, but it should depend ultimately on the king. Laws consecrated by custom should be considered inviolable. But space will not permit us to give any adequate account of Plato's political theories, which are a mixture of things good, bad, and indifferent borrowed from all the various forms of government and social organization, from theocracy to democracy, with original speculations, excellent in intention, but often arbitrary and chimerical, which have nevertheless been the fruitful source of subsequent speculations.

Plato's works were first published in Latin, in the translation of Marsilius Ficinus (Florence, 1483–84). The first edition of the text was by Aldus (Venice, 1513); the arrangement is that of Thrasyllus. An edition was published by Johannes Oporinus at Basel in 1534. The first good modern text is by Immanuel Bekker, published in 1816–18, with the Latin version of Ficinus, a critical commentary, and various readings; the arrangement is Schleiermacher's. There is an edition by Stallbaum (Leipzig, 1825), with subsequent reproductions; a Greek and Latin edition by Schneider and Hirschig (Paris, 1846–56); Greek by Hermann (Leipzig, 1851–53). Schleiermacher's translation (last edition, 1855–62) is the most celebrated German version. The French translation of Victor Cousin is distinguished by the excellence of style, which is a special characteristic both of author and translator. The last and best English version is by B. Jowett, M.A. (1871). Discussions on Plato's works, particularly by German scholars, and on particular works or parts of his system, are much too numerous to cite. The names of some of the leading critics have already been mentioned.

The followers of Plato have been divided into the old, middle, and new academies; or into five schools, the first representing the old, the second and third the middle, and the fourth and fifth the new academy. In the first are Speusippus, Xenocrates, and Heraclides, and others. The first reverted to pantheistic principles, the second to mysticism, and the last was chiefly distinguished as an astronomer. In the middle academy, of which were Arcesilas and Carneades, the founders of the second and third school, sceptical tendencies began to prevail. The new academy began with Philo of Larissa, founder of the fourth school; the fifth school was founded by his pupil Antiochus of Ascalon, who combined the doctrines of Plato with those of Aristotle and the Stoics, and prepared the way for neo-Platonism. The neo-Platonists ultimately became the antagonists of Christianity, to which among all the systems of ancient philosophy Platonism bears the strongest analogy. Platonic speculations still continued to appear among the early Christian fathers, but from the time of the establishment of the scholastic philosophy Platonism fell into complete discredit, and the philosophy of Aristotle was almost identified with the Christian religion, so that it became a sort of theological offence to question it. This eclipse of Platonism lasted till the Renaissance, when it again became the fashion for students of Greek literature to profess themselves Platonists, and from that time the philosophy of Plato has begun again to exercise its legitimate influence on human thought.

PLATOFF, or PLATOW, hetman of the Cossacks, was born in the southern part of Russia about 1763–65. He entered young into the military service, and in 1806 and 1807 he had the rank of lieutenant-general in the Russian army sent to the assistance of Prussia. He was afterwards employed against the Turks in Moldavia, and was made a general of cavalry. When the French invaded Russia in 1812 Platoff was again called into actual service, and though he was defeated at Grodno, and obliged to retire into the interior, he returned during the re-

treat of the enemy from Moscow, and, with twenty regiments of Cossacks, he harassed them in their flight, and contributed greatly to the advantages gained over them. In 1813, after the battle of Leipzig, he entered France, and was at Paris with the Emperor Alexander, whom he accompanied to England. At London he was the object of popular admiration, and a magnificent sabre was presented to him. In 1815 he commanded the Cossacks destined for the second invasion of France, and again made his appearance at Paris. After the restoration of peace he retired to Tcherkash, on the river Don, where he died in February, 1818.

PLATOON (French, *peloton*), a military term formerly used to designate a body of troops, usually half a company, who fired together. It is still used in the expression platoon exercise, which includes the manœuvres connected with the handling and using of the rifle.

PLATTDEUTSCH, or LOW GERMAN, is the language of the North German Lowlands, from the borders of Holland to those of Russian Poland. Its southern limit follows a line drawn through Aachen (Aix-la-Chapelle), Bonn, Kassel, Quedlinburg, Dessau, Wittenberg, Lübben, Fürstenberg, Meseritz, and Thorn. The northern boundary reaches the Danish frontier. The Dutch and Flemish languages also belong to the Low German dialects, but being associated with an independent political system, and having a literature of their own, are reckoned as distinct languages. The Low German dialects are distinguished from the written language and from other High German dialects, according to Grimm's Law (see PHILOLOGY), in that the former belong to his first, the latter to his second degree of consonantal changes. The consonants of the Low German are the same as those of the Mœso-Gothic, English, and Scandinavian languages; hence one of the most simple and obvious distinctions between Low and High German, is that the one dialect has *t* where the other has *s*, *k* for *ch*, *p* for *f*. The vowels vary much in the different Low German dialects, and cannot be taken for a distinctive mark.

Until the Reformation Low German was the general written language of the district above described; from that time the issues from the press in that dialect became gradually fewer, and by the end of the seventeenth century they had ceased altogether, and even as a spoken language, within its former limits High German has ever since been slowly superseding the Low. The only considerable literary monument of the first period of the Low German is the Hêliand, a poem ascribed to the ninth century. The second period is also poor in literary works, as the High German was patronized by the courts, and even poets born in Low German districts made use of it in their works. The Low German literature was thus mostly confined to matters of practical and everyday concern. It seldom rose above such compositions as rhymed chronicles, didactic poems, and books of law. In the higher regions of epic, lyric, and dramatic poetry the few works to which it could lay claim frequently possessed a flavour of popular wit and humour, but did not attain to the artistic excellence of contemporary High German poetry. Of the rhymed chronicles of this period we may mention the Gandersheim Chronik des Pfaffen Everard about 1216 (in Harenberg's Historia Gandershemensis; Hanover, 1734); and De Kronica van Sassen (Brunswick, 1826). Among the law books the most celebrated is the Sachsenspiegel, which contains the sources of the Lübeck, Bremen, Brunswick, and other codes. Among dramas are the Spiel van der Upstandinge, edited by Ettmüller (1851), and the Theophilus by Hoffmann (1853). The lay of Konine Ermenrikes dôt, edited by Gödeke (1851), is a specimen of the heroic legends of the period. The Netherlandish poem Reineke and the Eulenspiegel (which see) are included by some as belonging to the close of this period. In the sixteenth century a considerable number of works appeared in Low German, chiefly historical and theological. Among them may be noted, Die Pommersche Chronik of Thomas Kantzow, edited by Böhmer (Stettin, 1835); the Chronik des Landes Dithmarschen of Johann Adolfi, surnamed Neocorus, edited by Dahlman (two vols., Kiel, 1827). The last Low German Bible was printed in Lüneburg in 1622.

In recent times Low German literature has received a new impetus from Klaus Groth and Fritz Reuter, but except as a means of illustrating the common life of the people the attempted revival has completely failed. The scientific cultivation of the Low German dialects has not received the attention which their importance demands. Kinderling's Geschichte der niedersächsischen oder sog. plattdeutschen Sprache (1800) is excellent for its time, and has yet had no adequate successor. The grammar and lexicography of the Plattdeutsch have never yet been thoroughly treated. Of the carefully edited Wörterbuch der niederdeutschen Sprache of Kosegarten (Greifswald, 1857) only some parts have appeared. A copious catalogue of the literature connected with the Low German dialects is given by Hoffmann von Fallersleben in his Grundriss der deutschen Philologie (Breslau, 1836).

PLATTE, a river in the United States, which rises in the Rocky Mountains by two branches, one on the frontiers of Oregon and the other on the frontiers of Utah, 250 miles apart, and called respectively the north and south forks of the Platte. They flow east, and unite 400 miles from their source, when the united stream, flowing mostly east, falls into the Missouri on the frontiers of Iowa, 30 miles south of Council Bluffs, after a course of about 1600 miles. Principal affluents, the Elk-horn and the Loup Fork. It is from 1 mile to 3 miles broad, but is so shallow and encumbered with islands, and has such a rapid current, that it cannot be navigated.

PLATTENSEE. See BALATON (LAKE OF).

PLATTSBURG, a town of the United States, in the state of New York, on both sides of the Saranac, near its mouth in Cumberland Bay, on the west shore of Lake Champlain, 150 miles north of Albany. It has manufactures of leather, machinery, woollen and cotton cloth; numerous saw and other mills, and a considerable trade. Plattsburg has been selected as a military station, and large stone barracks have been erected on the shore of the lake in its vicinity. Some severe fighting, both by land and water, took place here in 1814, between the British and the Americans, to the advantage of the latter. Pop. (1880), 5245.

PLATYELMIA ('Flat-worms'), a division of the class Scolecida, represented by the Tæniada or Tape-worms, by the Trematoda or 'Flukes,' and by the Planarida (which see) and Nemertida (which see). These forms, which include both parasitic and non-parasitic animals, are primarily distinguished by the more or less flattened and compressed shape of their bodies. No segmentation or division of the body into segments or somites is seen—the apparent division of the body in the Tape-worms being due not to true segmentation, as in ordinary worms, but to the fact that each 'joint' in the Tæniada is a separate organism or *zoöid*, and not a mere segment. The term Platyelmia is used in contradistinction to Nematelmia—a group including worms possessing *rounded* bodies. See also NEMATELMIA, NEMERTIDA, TAPE-WORM, &c.

PLATYPUS. See MONOTREMATA and ORNITHORHYNCHUS.

PLATYRHINA. See MAMMALIA, MONKEYS, QUADRUMANA.

PLAUEN, a town in Saxony, in the circle of Zwickau, in a beautiful valley on the left bank of the Elster, 78 miles W.S.W. of Dresden. It is walled, and has a castle, several churches, a gymnasium, normal school, orphan and two other hospitals; manufactures of machinery, watches, philosophical instruments, blond, leather, wax-cloth, and screens, calico printfields, dye-works, paper, spinning, and other mills, and a pitch-oven. Böttcher, the inventor of Dresden porcelain, was born here. Plauen is an ancient place, and in 1430 was pillaged by the Hussites. Pop. in 1880, 35,078.

PLAUTUS, TITUS MACCIUS, one of the oldest Roman comic writers, was born at Sarsina, in Umbria, about B.C. 254; died about B.C. 184, as the manager of a company of players in Rome. Aulus Gellius tells us that for some time he was in a very destitute condition, and was compelled to earn his livelihood by turning a hand-mill. He must have possessed an inexhaustible fund of gaiety, since, even in a condition so unfavourable to poetry, he seems to have composed some comedies, the success of which appears to have enabled him to commence a literary career. About 130 plays were attributed to him in the time of Varro, but many of them were believed by critics to be spurious. Varro limited those undoubtedly genuine to twenty-one, although many others were admitted to have strong claims. About twenty of them, principally entire, have come down to us. The names are either borrowed from the persons of the piece, as Amphitruo (the husband of Alcmena, mother of Hercules), Curculio (Corn-worm, the name of a sponger), Epidicus, Pseudolus, Stichus (names of slaves), Bacchides (name of two frail fair ones), Menæchmi (the name of a pair of twins), Miles Gloriosus (the Braggart Soldier), Captivi (the Two Captives), Mercator (the Merchant), Pœnulus (the Carthaginian), Persa (the Persian), Truculentus (the Fierce); or from something which serves as a foundation of the play, as Aulularia, Cistellaria, Mostellaria, Fabula being understood (the Pot or the Treasure, the Casket, the Ghost). He took as his models the poets of the new Attic comedy, but he was essentially original, and his great popularity with the Romans, which continued after his death, was greatly due to his depicting Roman manners. The purity of his language and the refinement of his humour made him as much a favourite with scholars and critics as with the people. The Amphitruo has been imitated by Molière in his Amphitryon, and other modern dramatists have also copied him. The text of Plautus is very corrupt, and with frequent lacunæ and interpolations, many of the latter of modern origin. The first edition is that of Venice (1472). An excellent edition of the comedies of Plautus was issued by Ernesti (Leipzig, 1760, two vols.). Among modern editions may be mentioned that of Weise (Quedlinburg, 1837–38, two vols. 8vo); but no modern edition can compare with that of Ritschl so far as it has gone. There are also several editions of the separate plays. There is an English translation by Thornton and Warner (five vols. 1767–74). Lessing's Von dem Leben und den Werken des Plautus, in third volume of his collected works (Berlin, 1838), may also be mentioned.

PLAYFAIR, JOHN, natural philosopher and mathematician, the eldest son of James Playfair, minister of Benvie, in Forfarshire, was born there 10th March, 1748. He received his early education at home, and at the age of fourteen was sent to the University of St. Andrews to study for the church. While still a student he was selected by Professor Wilkie to lecture on natural philosophy to the professor's class during his absence from ill health, and at the age of eighteen he became a candidate for the chair of mathematics in Marischal College, Aberdeen. On the death of his father in 1772 he was nominated as his successor, and entered on his charge in Aug. 1773. In 1779 he published in the sixty-eighth volume of the Philosophical Transactions of the Royal Society an Essay on the Arithmetic of Impossible Quantities. In 1782 he resigned his living to become tutor to the sons of Mr. Ferguson of Raith. In 1785 he was chosen by Adam Ferguson as assistant professor of mathematics in the University of Edinburgh. In 1787 he commenced a series of papers in the Transactions of the Royal Society of Edinburgh. In 1795 he published for the use of his class an edition of the Elements of Euclid, in which he used algebraical signs to abbreviate the demonstrations. This has become a text-book, and has been frequently edited. On the death of Dr. Hutton (1797) he commenced the study of his works with a view to a biography, but found greater attractions in the advocacy of his theory, which led to his Illustrations of the Huttonian Theory of the Earth (1802). In 1803 he published his Biography of Hutton in the Transactions of the Society. In 1805 he was appointed to the chair of natural philosophy, and became secretary of the Royal Society of Edinburgh. In 1807 he was admitted a member of the Royal Society of London, to which he presented An Account of the Survey of Schehallien. In 1812 and 1816 he published the first and second volumes of his Outlines of Natural Philosophy. The first volume treats of dynamics, mechanics, hydrostatics, hydraulics, aerostatics, and pneumatics; the second of astronomy; the third, which was to have embraced optics, electricity, and magnetism, was never published. He also wrote for the supplement to the Encyclopædia Britannica a Dissertation on the Progress of Mathematical and Physical Science since the Revival of Letters in Europe, published in 1816. This work, which was not completed, interrupted an improved edition of his Illustrations of the Huttonian Theory, which he was never able to complete.

In 1815 the establishment of peace enabled him to extend his scientific investigations to the Continent. He went to Paris in company with his nephew, travelled thence to Switzerland, where he made important geological investigations; he then entered Italy by the Simplon. He spent the winter in Rome, and in spring proceeded to Naples, where he made fresh geological investigations. He returned by Florence and Geneva, passing also through Venice, Lyons, and Paris. In the ensuing summer he prepared a treatise on Naval Tactics, referring to the discoveries of Clerk of Eldin, which was published after his death. The observations made on his tour, which were intended for the illustration of his work on the Huttonian Theory, were never utilized for that purpose, and were only partially published. He died of a strangury, with which he had been afflicted for some years, 19th July, 1819. According to Jeffrey, Playfair was not more eminent as a man of science than pleasing in his deportment in society, in which, without trying to shine, he attracted all of either sex with whom he came in contact, as much by his amiable qualities as by the intrinsic value and unaffected character of his conversation. Playfair was a frequent contributor to the Edinburgh Review, and his papers in the Transactions of the learned societies were very numerous, and embraced a great variety of subjects besides those enumerated.

PLAYING-CARDS. See CARD.

PLEA, in English law, is the answer of a defendant to a plaintiff's declaration. Pleas were divided into pleas of the crown and common pleas. The

former relate to criminal prosecutions, the latter to civil suits. A dilatory plea was a plea in objection to the jurisdiction of the court, or praying for the suspension of the action, or in abatement of the declaration. Peremptory pleas were pleas in bar of the action. The pleas formerly used in civil proceedings in the Superior Courts are now superseded by the *statement of defence* introduced under the Judicature Acts of 1873 and 1875. In criminal actions the prisoner's pleas are (*a*) objections to the jurisdiction; (*b*) in abatement; (*c*) formerly acquitted, convicted or pardoned; (*d*) the general issue of not guilty.

In Scotland what are called pleas in law have quite a different meaning. They were introduced by act 6 Geo. IV. cap. cxx. s. 9, which defines them as 'a short and concise note, drawn and signed by counsel, of the pleas in law by which the action or defence is to be maintained; and in such note the matters of law so to be stated shall be set forth in distinct and separate propositions without arguments, but accompanied by a reference to the authorities relied on.' These pleas are subjoined to the action or defence, and it is the statutory duty of the lord ordinary, before closing the record, to suggest any plea which he may deem necessary to be answered by either party in order to exhaust the case. As new pleas may be raised after the closing of the record by a process of enrolment, including forty-eight hours' notice to the opposite party, the object of the statute, to have the whole case clearly stated before beginning the debate, has not been fully answered, the motive for an exhaustive statement of the pleas in law before beginning the action not being sufficiently strong to secure uniformity of practice.

PLEADING is the process in English law by which the issues to be determined in an action are ascertained. These issues may either be issues of law to be determined by the court, or issues of fact to be brought before a jury. The art of pleading appears to have been introduced into England by the Normans, no stated method of procedure having been traced among the Anglo-Saxons. In former times pleadings were delivered orally, whence in old law French they are frequently termed the *parol*. The forms of process have been frequently modified by statute, the more important rules now in use in the High Court being settled by the Judicature Act of 1875 as follows:—(*a*) Unless the defendant at the time of his appearance shall state that he does not require the delivery of a statement of complaint, the plaintiff shall within a specified time deliver to the defendant after his appearance a statement of his complaint, and the relief or remedy to which he claims he is entitled. The defendant on his part shall within a prescribed time deliver to the plaintiff a statement of his defence, set-off, or counter-claim, and the plaintiff shall in like manner deliver a statement of his reply to such defence, set-off, or counter-claim. Such statements shall be as brief as the nature of the case will admit, otherwise the expenses caused by unnecessary prolixity may be charged on the party using it. (*b*) Every pleading must contain a statement of the material facts on which the party pleading relies, but not the evidence by which they are to be proved. (*c*) Every allegation of fact in a pleading, if not denied specifically, by necessary implication, or stated to be not admitted in the pleading of the opposite party, shall be taken to be admitted, except as against an infant or person of unsound mind. (*d*) Each party in any pleading must allege all such facts not appearing in the previous pleadings as he means to rely on, and must raise all such grounds of defence or reply as the case may be, as if not raised on the pleadings would be likely to take the opposite party by surprise, or would raise new issues of fact not arising out of the pleadings. (*e*) No pleading shall, except by way of amendment, raise any new ground of claim or contain any new allegation of fact inconsistent with the pleadings of the same party. (*f*) It shall not be sufficient for a defendant to deny generally the facts alleged by the statement of claim, or for a plaintiff to deny generally the facts alleged in a defence by way of counter-claim, but each party must deal specifically with each allegation of which he does not admit the truth.—If the plaintiff does not deliver his statement of claim within the prescribed time, the defendant, at the expiration of such time, may apply to the court or a judge to dismiss the action with costs, and the court or judge may order the action to be dismissed accordingly, or make some other order which the court or judge shall deem just. The law relating to pleading is practically the same in most of the United States.

PLEBEIANS (*Plebs*), one of the great orders of the Roman people, corresponding to the commonalty in England. The time at which the Plebeians were recognized as a distinct order in the state is not ascertained; but they were at first excluded from nearly all the rights of citizenship. They differed from the *Clientes* in not being obliged to choose a patron, and were allowed to hold land by a free title, but had no share in the public domains; they were also obliged to serve in the army, but they were excluded from all public or political privileges. The whole government of the state, with the enjoyment of all its offices, belonged exclusively to the Patricians, with whom the Plebeians could not even intermarry. This was their condition under the monarchy. The civil history of Rome is subsequently to a great extent composed of the struggles of the Plebeians to assert their claim to the place in the commonwealth to which their numbers and social importance entitled them. When under Tullus Hostilius the Romans conquered Alba, they admitted the most distinguished of its citizens to the Patrician class, while the great bulk of them were added to the Plebeians. The same course was followed in other conquests, so that the numbers of the Plebeians were constantly augmenting, while they were for the most part of the same blood, and possessed of the same courage, determination, and other moral qualities as the dominant class, though less favourably developed by circumstances.

The Plebeians, like the Patricians, were divided into *gentes*, but they were excluded from the three Patrician tribes, and from the *curiæ*, which formed the basis of the governmental machinery of the state. Tarquinius Priscus seems to have made an attempt to introduce the Plebeians to the privileges of citizenship by dividing them into tribes, but it was not successful. Servius Tullius organized the Plebeians in tribes, of which he constituted four for the city and twenty-six for the surrounding subject territories. Each tribe had a tribune or prefect. They had their own social and religious privileges, and were allowed to meet in *comitia tributa* convoked by the tribunes. This organization under recognized heads, and the power of meeting, were of the greatest importance, and contained, as experience proved, the germ of all subsequent concessions. A semblance of political power was at the same time conferred on them by Servius Tullius. He divided the whole body of citizens into five classes according to the amount of their property, upon which division was founded the comitia centuriata or great national assembly, to which the greater part of the legislative and judicial power of the comitia curiata was transferred. The citizens, in this assembly, voted by centuries, but as the

equestrian order and the first class of citizens had the majority of the whole number of centuries, and voted first, it was only in the case of differences among them that it was necessary to consult the lower classes. Some of the noble Plebeian families were also admitted into the equestrian order. To follow the entire course of concessions which followed this beginning would demand an examination of the most complicated details of Roman history. The establishment of tribunes (B.C. 494), the law of the twelve tables (B.C. 451–450), the Lex Canuleia (B.C. 445), which permitted intermarriages; the admission to the consulate (B.C. 366), with the successive admission in B.C. 351 to the censorship, B.C. 336 to the prætorship, and B.C. 300 to the offices of pontifex and augur, were the leading steps in a succession of victories which culminated (B.C. 286) in the Lex Hortensia, which gave the plebiscita of the people the force of law. From this time the privileges of the two classes may be said to have been equal; the word *populus* now began to be used to designate the whole people, and *plebs* was employed sometimes to designate the assembly of the comitia centuriata, or popularly to distinguish the general mass of the common people.

PLEBISCITE, a form of voting introduced into France under the Napoleonic régime, and named after the Roman *plebiscita*. See ELECTION (POLITICAL).

PLECTOGNATHI, a sub-order of Teleostean fishes, distinguished by the maxillary and intermaxillary bones on each side of the jaw being firmly united together by bony union. The intermaxillary bones form the margin of the upper jaw, and they are thus soldered to the maxillaries; whilst the bones of the palate are also firmly joined to the skull. The union of the bones of the head is of a much more firm and intimate kind than in other Teleostean fishes. The head is of large size. The mouth is small, and the lips are hardly movable. The opercula or gill-covers are covered and surrounded by skin and membrane so as to limit in a very marked degree the gill or opercular opening. The body is generally of shortened conformation. The skin is usually of stout, horny texture, and may be covered by ganoid plates, scales, or by detached bony tubercles. The fins are small, and entirely soft. The ventral fins may be wanting. No pyloric cæca exist. The swimming or air bladder is a completely closed sac. As examples of the chief fishes included in this group we may cite the Trunk-fishes or Ostraciontidæ, the curious Balistidæ or File-fishes, the Globe-fishes (*Tetraodon* and *Diodon*), and the Sun-fishes or Orthagorisci. See SUN-FISH and TRUNK-FISH.

The Globe-fishes, of which the *Tetraodon Pennantii* of the Cornwall coasts, the *T. lævigatus* of Carolina, and the *T. lineatus* of the Nile may be cited as examples, are remarkable on account of the power they possess of distending the body at will with air, the air being forced into a large saccular expansion extending beneath the belly and opening from the œsophagus or gullet. Darwin says the air is swallowed, then forced into the sac, and retained there by muscular contraction. The possession of this inflated sac enables the fish to float on the surface of the water, belly upwards—a faculty by means of which it may possibly escape from its enemies which exist in greater depths—whilst the spines with which the skin is covered give to the fish an additional protection. These fishes are hence known as 'Sea-porcupines.' The allied genus *Diodon* is represented by various species, of which the *D. pilosus* may serve as a familiar example. The fishes belonging to this latter genus mostly occur in warm or tropical seas. See also OSTRACION.

PLEDGE, or PAWN, is a species of bailment, being the deposit or placing of goods as security for the payment of money borrowed, or the fulfilment of an obligation or promise. It is distinguished, in English law, from a mortgage of chattels by the circumstance that the legal property in the chattel mortgaged is in the mortgagee, whereas the legal ownership of goods pawned remains in the pawner, though according to the definition of a pawn and pledge the pawnee not only has the right of possession, but must be in possession. If the money is not paid at the time stipulated the pawn may be sold by the pawnee, who may retain enough of the proceeds to pay the debt intended to be secured. In some cases the terms of the deposit are the forfeiture of the pawn in case the pawner does not fulfil the promise or obligation to guarantee which the pawn is given. See PAWNBROKER.

PLEIADES, the daughters of Atlas by Pleione, or the Oceanid Æthra. They were sisters of the Hyades, and seven in number. Six of them were visible, the seventh invisible. The seventh is called by some Sterope, by others Electra. She is variously said to have become invisible from shame or from grief. The sisters are said to have made away with themselves from grief at the death of the Hyades, and to have been placed in the stars as a cluster behind Taurus.

PLEONASM (Greek, *pleonasmos*, a redundancy), in rhetoric, is a figure of speech by which we use more words than seem absolutely necessary to convey our meaning, in order to express a thought with more grace or greater energy; it is sometimes also applied to a needless superabundance of words.

PLESIOSAURUS, a genus of extinct reptiles forming the type of the order Plesiosauria or Sauropterygia (Owen). Of this genus upwards of twenty species have been described, and the remains of these reptiles occur from the Lias to the Cretaceous or Chalk rocks inclusive; these forms being thus exclusively of Mesozoic age. The length of the largest specimens average from 18 to 20 feet. Familiar species are the *Plesiosaurus dolichodeirus* (see Pl. LXXXIII. fig. 24) of the Lias formations, the *P. affinis* of the Upper Oolites, *P. Bernardi* of the Chalk, *P. macrocephalus*, *P. Hawkinsii*, *P. homalospondylus* of the Whitby Lias, *P. pachyomus*, &c. &c. The remains of this curious genus were first brought to light in the Lias of Lyme Regis in 1822. They were first noticed by Dean Conybeare and Sir H. De La Beche, who named them *Plesiosauri* (*plesios*, near, *sauros*, lizard) for the reason that the genus was more nearly related to the lizards than the *Ichthyosaurus* (which see), another extinct reptilian form found in the same formation. Very perfectly preserved skeletons of Plesiosauri have from time to time been discovered, and have been made the subject of important memoirs by Owen and other palæontologists. Cuvier regarded the structure of the Plesiosaurus as 'the most singular, and its characters the most anomalous that had been discovered amid the ruins of a former world.' Dr. Buckland, writing of this genus, describes its members as uniting to the head of a lizard 'the teeth of a crocodile, a neck of enormous length, resembling the body of a serpent, a trunk and tail having the proportions of an ordinary quadruped, the ribs of a chameleon, and the paddles of a whale.' So far as can be ascertained from the careful examination of the fossilized remains no scales, plates, or other structures resembling an exo- or outer skeleton existed in the Plesiosauri. The bodies of the vertebræ or joints of the spine were flat or slightly concave, or possessing a slight convexity in the middle of the concavity. The neural arches and spines of the vertebræ were not generally ossified to the vertebral bodies. Long

transverse processes existed on the vertebræ. The front ribs of the chest articulated with the vertebræ by simple and single or undivided heads. The cervical or neck vertebræ numbered forty or fewer. From twenty to twenty-five dorsal segments existed; and two sacral vertebræ and from thirty to forty caudal or tail segments completed the spine. No distinct breast-bone or sternum was developed, nor do sternal ribs appear to have existed; but certain ossifications were developed in the ventral or lower wall of the abdomen. These ossified pieces were arranged in transverse rows from before backwards, each row comprising a single median bone slightly bent upon itself, and of six other overlapping bones, three on each side. The head was not more than $\frac{1}{12}$th or $\frac{1}{13}$th of the length of the body. The neck was as elongated in some species relatively to the body as that of a swan, but in other species again it was proportionally shorter. The tail was relatively short, the fore limbs or paddles being shorter than the hinder members. The snout was of a tapering form. The orbits or eye-cavities were large and wide. The teeth were sharp and curved, the outer surfaces of their crowns being grooved. Each tooth was sunk in an alveolus or distinct socket. The eyes do not appear to have been strengthened by a circle of sclerotic or bony plates in the outer membrane of the eye, as in Ichthyosauri. The bones of the shoulder-girdle were formed by two large coracoid bones, two scapulæ or shoulder-blades of peculiar conformation, two clavicles or collar-bones, and a bone variously regarded as an interclavicle or an episternal bone. Six bones existed in the wrist, and were arranged in two rows. The pelvis was well-developed; and both fore and hind limbs were in all probability inclosed within a membrane so as to form swimming paddles like those of existing Cetacea.

With regard to the habits of the Plesiosauri it may reasonably be inferred that these reptiles were aquatic and inhabited the estuaries of rivers and shallow waters, occasionally swimming out to sea. Their gait on land would necessarily be awkward and difficult. The elongated neck would serve to enable them to descry their prey from among or over the tops of the reeds and vegetation amid which they might lie concealed in the banks of rivers or in estuaries, whilst this same length of neck would adapt them for readily seizing their prey, which consisted probably in greater part of fishes.

Pliosaurus is an extinct reptile included in the same order with the Plesiosaurus, and distinguished chiefly by its greater size and by the larger head borne on a short neck. These latter reptiles occur as fossils in the middle and upper oolites only. The teeth were simple, conical in shape, and of large size. The neck vertebræ were compressed from before backwards, and thus resembled those of the Ichthyosauri. Some of these Pliosaurs attained a length of upwards of 40 feet, for example, *Pliosaurus brachydeirus*. The tooth of *P. grandis* from the Kimmeridge clay of Oxford measured about 8 inches or more, its girth at the base of the crown being 7½ inches, and its diameter at the same place being 2 inches 7 lines. In size this tooth resembles that of the living sperm whale.

PLETHORA is a disease of the blood, consisting of exuberance of blood or excessive fulness of the vascular system. Scientific writers have distinguished various kinds of plethora; the most important distinction is that between an occasional turgescence of the blood and a permanent increase of its volume beyond the wants of the system.

Occasional plethora is caused by the excitement and expansion of the capillary vessels, produced by high temperature, and by over-indulgence in eating and drinking. Persons constitutionally plethoric are exposed to it as well as others. Amputation is a frequent cause of plethora, as the digestive powers do not immediately accommodate themselves to the reduced wants of the system, and too much food is liable to be taken and too much blood formed. Plethora has two leading causes—the introduction into the vascular system of too much nutriment, and the deficient activity of the secreting organs, whereby the nutritive matter is insufficiently removed from the blood. A tendency to plethora thus generally develops at an advanced age, when the activity of the secretive powers has been considerably diminished. Plethora is often confounded with obesity, from which it is quite distinct, obesity being consistent with deficiency of blood. In lean persons plethora is recognized by a full, strong pulse, and large, well-filled veins. Plethora produces a diminution of activity and a greater tendency to sleep than in health; these symptoms increase as it becomes aggravated, and culminate in lassitude and vertigo, turgid countenance, suffused eyes, palpitations of the heart, and similar phenomena. It is liable to lead to fever or visceral congestion. The treatment of plethora is entirely negative, and is suggested by the causes of the disease. Abstinence and exercise are its two most important elements, and their combination depends upon the circumstances of the individual case. Generally abstinence from malt liquors, wines, or spirits is recommended.

PLEURA, the serous membrane (see MEMBRANE) lining the cavity of the thorax or chest, and which also covers the lungs. Each lung is invested by a separate pleura or portion of this membrane; the structure being spoken of rather as double pleuræ than as a single membrane. Like all serous membranes, and as described in the article MEMBRANE, each pleura is a completely closed or shut sac, and does not communicate with its companion membrane; and it further resembles the other serous membranes, in that one side or part of the sac lines the containing cavity, whilst the other part or fold is reflected over the contained organs. In the thorax, therefore, each pleura is found to consist of a portion lining the walls of the chest, this fold being named the *pleura costalis* or *parietal layer* of the pleura. The other fold, reflected upon the lung's surface, is named in contradistinction the *pleura pulmonalis*, or the *visceral layer*. These two folds inclose a space known as the *pleural cavity*, which in health contains serous fluid in just sufficient quantity to lubricate the surfaces of the pleuræ as they glide over one another in the movements of respiration. The abnormal increase of the fluid of the serous sac constitutes the condition known as *hydrothorax* or pleural dropsy, whilst it may also contain air—as seen in cases where the lung has been wounded—constituting the lesion known as *pneumothorax;* or pus may be present in the pleural cavity, when the disease is known as *empyema*.

In front the two pleural sacs touch one another at a single point only, about the middle of the sternum, and they therefore inclose a space between them known as the *mediastinum*, which is again divided into anterior, middle, posterior portions. (See LUNG.) In the mediastinal space the heart and other organs of the chest are situated, excepting the lungs, which are contained as already explained, each within its own pleural sac. The pleura lines the ribs laterally, and a portion of the sternum or breast-bone in front. From the breast-bone it passes backwards over the pericardium (which see) or sac inclosing the heart. From this latter point the membrane is reflected over the front portion of the *root* of each lung; the root being the portion of the lung near its middle and inner surface, where the great vessels, bronchial

tubes, and other structures enter the organ. A fold of the pleura, constituting the *ligamentum latum pulmonis*, or 'broad ligament of the lung,' passes downwards from the root of the lung to the diaphragm or 'midriff,' and serves to retain the lower part of the lung in proper position. The back portion of the root of the lung is next covered by the pleura, and thence it passes over the entire lung to the sides of the vertebræ and ribs, and thus reaches the sternum and point from which it started. Inferiorly the pleura covers the upper surface of the diaphragm. The apex of the pleura projects above into the neck about an inch above the border of the first rib. The pleura of the right side is wider, shorter, and extends higher in the neck than that of the left side. The outer aspect of the membrane adheres to the lung surface, and also to the pulmonary vessels as these leave the pericardium or heart-sac. It is also attached to the diaphragm below; elsewhere it is but loosely connected to the contiguous surfaces.

The pleura is supplied with blood-vessels from the internal mammary, intercostal, phrenic, and other arterial trunks; its veins corresponding in nature to the arteries. Its nervous supply is derived from the phrenic and sympathetic nerves, whilst the absorbent or lymphatic vessels are also numerous.

The diseases to which the pleuræ are subject, are chiefly *pleurisy* (which see), or inflammation of the membrane; *pneumothorax*, with or without effusion of fluid into the pleural cavity (*hydrothorax*); and *empyema*. *Hæmothorax*, or blood in the pleural cavity, generally results from accidental wounding of the intercostal arteries. Inflammation of the pleura of itself may terminate in hydrothorax or empyema, the inflammatory products in this, as in other cases, appearing in the form of serous fluid or pus respectively. On the inflamed surfaces of the pleura a deposit of lymph may be formed, which may cause the so-called *friction sounds* of the physician to be heard on listening to the movements of respiration. These sounds are produced by the roughened surfaces rubbing one against another.

PLEURISY, the inflammation of the pleura or investing membrane of the lungs. This disease was for a long time confounded with pneumonia, with which it is often associated. The compound disease is sometimes designated pleuro-pneumonia.

Pleurisy is divided into acute or chronic. Acute pleurisy is a very common complaint, less so among children and old people than in adults between the time of puberty and old age. It is due to a variety of causes not always easy to trace, but the most common exciting cause is cold acting upon the body while in a state of heat and perspiration. It is also a secondary affection in various diseases, as pneumonia, rheumatism, &c.

It is sometimes preceded by premonitory symptoms, as susceptibility to cold, loss of appetite, &c.; but the announcement of its attack is generally sudden, and is made by an acute pain in the region of the breast. This pain, commonly called a stitch in the side, occurs at each inspiration, and checks the breath of the patient. The pain is most at the lateral margin of the diaphragm, but may occur at any part of the affected side of the chest. It is sharp and lancinating, and often severe. It has been ascribed to various causes. Copland assigns it to the stretching of the inflamed fibrous layer of the membrane during inspiration, Beau to the concomitant inflammation of the intracostal nerves. A short, dry, suppressed cough frequently attends pleurisy. Sometimes it is attended with expectoration due to catarrh. The combination of the cough with the difficulty of respirations sometimes produces symptoms approaching to asphyxia. The local symptoms may be preceded or accompanied by fever. While the inflammation continues its progress a sero-albuminous effusion takes place, and when this develops the febrile symptoms subside. When the effusion becomes considerable the affected side is enlarged, and the organs become more and more displaced as the amount of the fluid increases. Double pleurisy is when the disease attacks both sides of the chest at the same time in a primary form. It is rare, but instances of a double attack in a secondary form are more common.

Acute pleurisy is seldom fatal from the mere amount of effusion, unless when it is double, or complicated with other diseases of the lungs or surrounding parts. It is, however, liable to dangerous complications. The acute symptoms generally last only a few days, but the effusion may continue much longer. It is sometimes fatal even without complications, but in a good state of general health it usually ends in recovery. The general form of treatment adopted for pleurisy is antiphlogistic. Blood-letting was formerly freely employed. This is now resorted to with great caution. When it is deemed unadvisable the application of leeches to the side is substituted. The free exhibition of calomel, combined with opium and antimonials, is the treatment most relied on in acute pleurisy. The calomel is continued till the approach of salivation. Emetics and purgatives are sometimes used as auxiliary remedies. Local treatment, such as blistering, is often needed after the acute symptoms have subsided.

Chronic pleurisy is either primitive, or the result of acute pleurisy. It may either extend to the whole pleura, or be confined to a more or less circumscribed point of it. Its symptoms are similar to those of acute pleurisy, but of a less degree of intensity. The pain in the side is slight, dull, and fugitive. It is chiefly characterized by effusion, which accumulates in the pleural cavity, and it soon tends to produce lesions, adventitious formations, and other complications in the surrounding organs. Besides local treatment purgatives and diuretics are used in the case of chronic pleurisy. If the disease does not yield to these remedies, the liquid must be evacuated by the operation of *paracentesis thoracis*.

PLEUROBRACHIA, a genus of Cœlenterate animals belonging to the highest order (Ctenophora) of that sub-kingdom. The name *Cydippe* has been sometimes applied to this genus, the representatives of which exist as free-swimming organisms, possessing clear, transparent, colourless, spheroidal bodies, somewhat resembling a melon in shape, and averaging a marble in size. These beautiful forms may be met with in vast numbers around our coasts in the calm summer seas. At the upper or oral pole of the body the mouth is situated, and around the external surface of the body, disposed in meridional bands running from pole to pole of the organism, eight band-like structures, termed *ctenophores*, are found. These structures, from the presence of which the order Ctenophora derives its name, consist each of a band-like surface bearing a number of transverse ridges, each of which bears a fringe of vibratile cilia. The comb-like disposition of the ciliated ridges has thus given origin to the term Ctenophora (from Greek *kteis, ktenos*, a comb). The cilia or eyelash-like filaments are longest in the middle of each ridge. Two long flexible tentacles, furnished with cirri or filaments, stretch away from a chamber or sac on each side of the body. These tentacles are capable of being retracted at will within the sacs. The mouth opens inferiorly into a stomach, which is continued below into a funnel-shaped cavity, known as the *infundibulum*, and from the latter cavity two

apical canals are given off, one on each side, to open at the apical pole or extremity of the globular body, opposite to the oral or mouth pole. The infundibulum also gives origin to two *paragastric canals*, which form blind or pocket-like sacs on each side of the stomach; and to a pair of *radial canals*, which divide and subdivide as they proceed towards the outer surface of the organism. These radial vessels finally open into the *ctenophoral* canals, which underlie the ctenophores of the outer surface of the body. These canals are lined by cilia, and the entire system of vessels thus partakes of the nature of a circulatory apparatus, by means of which the products of digestion are circulated throughout the body. A structure known as the *ctenocyst* exists as the lower or apical pole, and consists of a clear sac filled with fluid, lined with ciliated epithelial cells, and containing particles of carbonate of lime. Upon the ctenocyst a small nervous ganglion is placed, and this supplies nerve filaments to that structure, which is thus supposed to be an organ of sense, most probably corresponding in function to an organ of hearing. The generative organs are disposed in band-like masses or in folds, one on each side, below the ctenophoral canals. The entire system of canals corresponds in its homology to the internal division of the body in other Actinozoa, in which class of the Cœlenterata the order Ctenophora is contained.

Of the genus Pleurobrachia the best known species are the *P. pileus*, *P. densa*, of the Mediterranean; *P. Flemingii*, *P. lagena*, &c.

PLEURONECTIDÆ. The group of Teleostean fishes included in the section Anacanthini of that order, and represented by the Soles, Flounders, Brill, Turbot, Plaice, &c. The scientific name Pleuronectidæ therefore corresponds to the popular designation of 'Flat-fishes,' applied to these forms. As mentioned in the article PLAICE (which see), these fishes are to be regarded as *flat* only in the sense that the *sides* of the body are more compressed than in ordinary fishes. The surfaces which appear flat in the sole and its allies are in reality the *sides*, and not the back and belly of these fishes, as may be seen by noticing that a pectoral fin and the gill-opening exist on each flat surface of the fish; these fins being paired in all fishes, and, together with the gill-openings, being situated one on each side. The Pleuronectidæ lie on one side, this side being generally white or colourless; the opposite and upper side of these fishes being dark coloured. Long dorsal and anal fins exist in all. The head and mouth are asymmetrical, and the pectoral fins are generally unequal in size; the ventral fins frequently seeming as if continuations of the anal fin. The body is usually covered with ctenoid scales of small size. The bones of the head are twisted or contorted during the growth of these fishes, so that both eyes are brought to one side of the head—a structure serving to strengthen the idea that this latter *side* represents the back of the Pleuronectidæ. The side to which the eyes are thus twisted round is the uppermost or dark-coloured side, and this side in some (as in the sole) may be the right side of the body, or the left (as in the turbot). The branchiostegal rays number six. The mouth is small, and armed with minute teeth. The abdominal cavity is very limited in size, the organs of the body being contained within a small space under the throat, in which situation the anus or vent opens. The greater part of the body in these fishes is thus made up of a large flat disc-like muscular tail. The swimming-bladder is absent in these fishes, which mostly inhabit the bottom waters, and prefer sandy ground. The food consists chiefly of small crustaceans, molluscs, worms, or even smaller fishes. They swim with the dark-coloured side uppermost, and progress by a kind of undulating motion of the entire body.

The most familiar genus is that of the *Platessa*, including the Flounders (*Platessa flesus*), Plaice (*P. vulgaris*), and Dab (*P. limanda*). The eyes are on the right side in this genus; the body being rhombic in form. The members of the genus *Rhombus*, represented by the Turbot (*R. maximus*) and Brill (*R. vulgaris*), possess the eyes on the left side, and teeth in the throat as well as jaws; the dorsal fin commencing in front of the eyes. The Soles (*Solea vulgaris*), included in the genus *Solea*, have the eyes in the right side, and the mouth twisted to the left side. Teeth exist in both jaws, but only in the left side of each; and the body is oval in shape. The Holibut (*Hippoglossus vulgaris*) is a very large fish, and may attain a weight of 500 lbs., and measure above 7 feet in length. In this genus the eyes are placed in the right side, and the dorsal and anal fins begin behind the eyes. One specimen, landed in the Edinburgh market in 1828, and which was captured off the Isle of Man, measured 7½ feet in length, 3 feet 6 inches in breadth, and weighed 320 lbs. The turbots, although also large fishes, do not attain so great dimensions as the holibut; a very large turbot may weigh 190 lbs., and measure 6 feet across. The holibut is an inhabitant of Northern and Greenland Seas, and forms the prey of the dolphins and other marine forms. The genus *Monochirus* is nearly allied to the soles. This genus is represented by the *M. lingula* and *M. linguatula*. The pectoral fins are very small, and the left is occasionally wanting. The body is elongated and oval in shape. See also ICHTHYOLOGY, PLAICE, SOLE, TURBOT, &c.

PLEURO-PNEUMONIA (*épizootie*) is a form of pneumonia peculiar to the bovine race. It is highly contagious, and proves rapidly fatal. It first manifests itself in a morbid condition of the general system; but its seat is in the lungs and the pleura, where it causes an abundant inflammatory exudation of thick plastic matter. The lungs become rapidly filled with this matter, and increase greatly in weight. Whether pleuro-pneumonia is specifically a local or general disease is disputed, as also the manner of treatment. On the one hand bleeding and mercurial treatment, as in pleurisy and pneumonia, is recommended. On the other, evacuating remedies, maintaining the strength of the animal, and promoting the action of the skin, bowels, and kidneys. Pleuro-pneumonia is one of the diseases mentioned in the Contagious Diseases Act.

PLEYEL, IGNAZ, a popular modern instrumental composer, born in Austria in 1757, studied composition under Haydn, and after he had completed his education under the most favourable circumstances, proceeded in 1786 to make a tour through Italy and France, where he was everywhere received with the greatest favour. In 1787 he accepted the appointment of chapel-master to Strasburg cathedral; but had not occupied it long, when, in consequence of the revolution, the church service ceased, and the cathedral was shut up. Inclined to the revolution and the freedom anticipated from it, he had endeavoured to gain the friendship of the government by composing a hymn on liberty, but in 1793 was obliged to flee. He proceeded to London; became again connected with Haydn, and gave a series of concerts with great success. He soon after went back to France, and at a later period founded a musical establishment, which became one of the most important in Europe. In 1801 he commenced editing the Bibliothèque Musicale, in which he inserted the best works of the Italian, German, and French composers. His own works, chiefly instrumental pieces, are light, pleasing, and expressive. The earliest of them are

the best. One of the most popular is the well-known German hymn which bears his name. He died at Paris in 1831.

PLICA POLONICA, a disease peculiar to Poland and the immediately adjacent districts. It is indicated by the matting of the hair, which becomes agglutinated by a nauseous exudation from the roots, the bulbs become enlarged, and the hair swells and becomes soft. Plica is said to have appeared in Poland about the end of the thirteenth century, and is now gradually wearing out. Authorities differ as to whether it is a primary disease, or a result of internal, particularly febrile disease. When it is symptomatic it is supposed to relieve the primary disease, and it is recommended that it should not be interfered with until the commencement of recovery by the growth of healthy hair under the tangled mass, which may then be shaved off. The treatment of plica itself, considered as an idiopathic disease, is for the most part empirical, and beyond cleanliness and attention to diet there appears to be nothing in it determined with certainty.

PLINTH (Greek, *plinthos*, a brick), the lower square member of the base of a column or pedestal. In a wall the term plinth is applied to two or three rows of bricks which project from the face.

PLINY (Caius Plinius Secundus), author of the Historia Naturalis, commonly called *Pliny the Elder*, was born A.D. 23, at Verona, or more probably Novum Comum (Como), to which his family belonged. He came to Rome at an early age, and having means at his disposal availed himself of the best teachers. About the age of twenty-three he served in a military campaign in Germany, under L. Pomponius Secundus, and obtained the command of a troop of cavalry. He appears at this time to have travelled over most of the frontier of Germany. During the intervals of his military duties he composed the treatise De Jaculatione Equestri, and commenced a History of the Germanic War, which he subsequently completed in twenty books. During the remainder of the reign of Nero he lived in retirement, and composed an educational work, called Studiosus, in three books, containing instructions for the training of an orator. He also wrote a grammatical work, entitled Dubius Sermo. Towards the close of this reign he was appointed procurator of the emperor in Spain. In 71 his brother-in-law died, leaving him the guardianship of his nephew, the younger Pliny, which he intrusted during his absence in Spain to Virginius Rufus. He returned to Rome before A.D. 73, and then adopted his nephew. He was admitted among the number of the intimate friends of Vespasian. His nephew has left an account of his life at this period, which was one of constant study. He made extracts from all the books he read, or had read to him, and at his death left his nephew 160 volumes of these notes. His Natural History, which he compiled from materials accumulated in this way, was published about 77. He perished in the eruption of Mount Vesuvius which overwhelmed Pompeii and Herculaneum in 79. The only work of Pliny which is now extant is his Natural History. It is divided into thirty-seven books, and is, according to his own account, a compilation from upwards of 2000 volumes. It embraces the domain of natural history in the widest sense, including astronomy, geography, and meteorology. It even goes beyond what natural history in any sense would include—treating of the fine arts, and human institutions and inventions. The first edition of Pliny's Natural History was published at Venice in 1469. The edition of Hardouin (Paris, 1685, five vols. 4to) is the first critical edition. The edition of Panckouke (Paris, 1829–33), with a French translation, and notes by eminent modern naturalists and scientific men, including Cuvier, is of great value. The best edition of the text is that of Sillig (Leipzig, 1831–36, five vols. 12mo); the last vol. contains a valuable collation of MSS. Pliny was translated into English by Dr. Philemon Holland (London, 1601, two vols. folio). There is a translation in Bohn's Classical Library by Dr. Bostock and T. H. Riley. There are numerous translations into foreign languages.

PLINY (Caius Plinius Cæcilius Secundus), *the Younger*, a nephew of the former, was born A.D. 61 or 62, probably at Comum (Como). Having lost his father at an early age, he was adopted by his uncle, and was carefully educated. He applied himself early with the greatest assiduity to the study of eloquence and philosophy, and when a boy of thirteen years of age made an attempt to write a tragedy in the Greek language. In Syria, where he was the commander of a legion, he enjoyed the society of the philosopher Euphrates, and afterwards made his appearance in Rome as an advocate with success, filled several public offices, and was consul in A.D. 100. In A.D. 103 he was appointed proprætor or governor of the province of Pontica, which office he administered for almost two years to the general satisfaction. He was one of the most distinguished and best, and, we may also add, one of the most fortunate men of his age. He had most of the requisites for the enjoyment of life—he was rich, he possessed a cultivated mind and a generous heart, and was fortunate in his friends. The time of his death is unknown. He was twice married, but had no children. As an author he laboured with ardour. He attempted several departments of literature, both in prose and poetry. Of his writings only a collection of letters in ten books, and a panegyric on Trajan, remain. The letters are addressed to different friends, some of them to the emperor, and are on various subjects. They appear to have been collected by the author himself, and were probably written with a view to publication. The most valuable among them is the celebrated correspondence between Pliny and Trajan, containing the letters regarding the persecution of the Christians in his province which have drawn forth so much comment. The sentence of death seems to have been passed upon any one admitting himself a Christian, though nothing more could be brought out in evidence against them than that they were in the habit of meeting on a fixed day before it was light and singing a hymn to Christ as God; they also, Pliny says, took an oath to avoid theft, robbery, adultery, breach of faith, and denial of a deposit. Pliny examined by the torture (as was the Roman custom) two of his female slaves who were Christians, but could not discover that the Christian religion was anything worse than 'a perverse and extravagant superstition.' As the superstition was spreading, Pliny asked the emperor's advice as to how it should be dealt with. The emperor's directions were that persons supposed to be Christians were not to be sought for; if they were accused, and the charge proved, they were to be punished; but if they denied the charge, and offered up their prayers to the heathen gods, they were to be let alone; charges not bearing the name of the informant were not to be received, as they had been. It must be remarked that all meetings at irregular times and places, and especially nocturnal meetings, were odious in Roman eyes, and enough of themselves to subject the participators in them to the interference of the authorities. But it is not clear that the Christians would as yet have been allowed to assemble openly. His Panegyric on Trajan is a mere eulogium, containing little information, and fulsomely expressed. The Letters and the Panegyric were edited, together with

notes, by Gesner (Leipzig, 1739), Ernesti (Leipzig, 1770), and others. A later critical edition of the Letters, with notes, was edited by Gierig (Liepzig, 1800), and the complete works of Pliny by the same (Leipzig, 1806); afterwards by G. H. Schäfer (Leipzig, 1815); and by Titze (at Prague, in 1820). The Panegyric was edited by Gierig, with notes (Leipzig, 1796), who also published a work On the Life, Moral Character, and Literary Reputation of the Younger Pliny. The Epistles of Pliny have been translated into English by Lord Orrery and Mr. Melmoth.

PLIOSAURUS. See PLESIOSAURUS.

PLOCK, a town in Russian Poland, right bank of the Vistula, 60 miles north-west of Warsaw, on a height. It is walled, divided into the old and the new town, and has no less than twenty-five squares, of which one in the old town is very regularly built. It has a handsome cathedral; a bishop's palace, in which the courts of justice hold their sittings; two monasteries, and a convent, a synagogue, Piarist college, a gymnasium, and several elementary schools; a theatre, an orphan asylum, and poor-house; and a considerable trade, particularly in skins; and several large fairs. Pop. 22,127.—The government of Plock has an area of 4200 square miles of a level and moderately fertile territory, with a pop. of 530,099.

PLOTINUS (*Plotinos*), the systematic founder of Neo-Platonism, was born about 203 or 204 A.D., according to Suidas at Lycopolis, in Egypt. In his intercourse with his pupils and acquaintances he avoided all reference to the antecedent circumstances of his life, his age, nativity, or parentage; and Porphyry, his biographer and most intimate friend, could tell nothing on these matters from his own communications. He held, in fact, an opinion approaching to contempt for all the circumstances of bodily existence, was afraid of his birth-day being held in honour, and but for a stratagem of Amelius, who introduced a portrait-painter to his lectures to paint him from memory, would have defeated the wish of his friends to preserve his likeness to posterity. It is conjectured that he was of Roman descent, probably a freed-man. Until his eighth year, before which period he had been sent to school, he was fed from the breast. It was in his twenty-eighth year that the desire to study philosophy awoke in him. His first teacher Alexandriens gave him no satisfaction. He then fell into great despondency, and was brought by a friend to Ammonius Saccas, a philosopher who was brought up a Christian, and has written some works on Christian theology, but who, according to Porphyry (controverted by Eusebius and Jerome), returned to the Hellenic faith. He remained with him till his thirty-ninth year. In 242 he joined the expedition of the Emperor Gordian to the East, in order to learn the philosophy of the Persians and Indians. After the death of Gordian he reached Antioch with great difficulty, and arrived at Rome in his fortieth year. It was here he subsequently lived and taught. The leading pupils of Ammonius, besides Plotinus, were Origen (the Neo-Platonist), Herennius, and Longinus. Ammonius taught verbally, and Plotinus had entered into an agreement with Origen and Herennius not to commit his doctrines to writing. This agreement was first broken by Herennius, when Origen considered himself relieved from it. Plotinus continued still to observe it for some time. His lectures at this time are described by Amelius as distinguished by want of order and superfluity of words. About 254 his friends induced him to put his doctrines in writing. From this time till he was joined by Porphyry (about 262–264) he composed twenty-one books, which were only put into the hands of the initiated. During Porphyry's stay in Rome he composed twenty-four, and after Porphyry had left for Sicily (267–268) other nine. On account of the weakness of his sight Plotinus left the correction of his works to Porphyry. He was wholly indifferent to style, and exclusively occupied with the matter of his teaching; but he was accustomed to think out his ideas so thoroughly before committing them to writing that they required only literary correction. Porphyry was his literary executor, and has arranged his works in six Enneads. Porphyry considered those written during his own stay at Rome the most valuable, but he has not observed a chronological order in their arrangement. The works of Plotinus were highly valued by Longinus, although that philosopher was in no sense a Plotinist. Plotinus's discourse, as well as his writing, was marked by energy and enthusiasm. He was in fact a preacher. His fervour is said to have increased the beauty of his countenance. His teaching secured him great respect and popularity among those who did not receive Christianity. Parents left their children to his care, and his house was full of orphans of both sexes intrusted to his guardianship. Although neglectful in his own person of temporal interests, he showed no want of practical shrewdness in looking after the estates of his wards. Plotinus enjoyed the favour of the Emperor Gallienus, from whom he obtained the rebuilding of two destroyed towns in the Campania, with a view to their being governed according to the laws of Plato. Various dates from 262 to 270 are given for the death of Plotinus. He was afflicted with disease of the bowels, for which he used no remedy but rubbing; and his assistants having died of the plague, the leaving off of this application induced a relaxation of the throat, which deprived him of speech. He retired to the country house in the Campania of a deceased friend named Zethus, where he died.

Plotinus was one of the great masters of philosophy. The value of his system depends less upon the intrinsic truth it contains than upon its historical importance, and its adaptation to a certain class of human sympathies. The historical value of the system, which is great both in its antecedents and consequents, is due partly to the circumstances out of which it arose, and partly to the genius and originality of its founder. It had its source at the junction of two independent streams of thought, which, already fortuitously united, received a new direction from the individual energy of the mind of Plotinus. It is uncertain how much he owed to his immediate teacher Ammonius; but as Longinus, who was a constant hearer of Ammonius and of Origen, steadfastly rejected the doctrines of Plotinus, it is probable that the latter treated Ammonius, as he certainly treated Plato, according to his own individuality. Plotinus was well acquainted with the older Greek philosophy, with the Ionian and the Eleatic schools, with Plato and Aristotle and other founders of systems, and according to the eclectic tendencies of his day he believed there was a fundamental unity in these various systems. Ammonius, in particular, held the substantial agreement of Plato and Aristotle. It was to Plato, however, that Plotinus looked as his great authority. He believed himself a strict follower of Plato, and his own system a legitimate development of the principles of that great philosopher; but if the system of Plotinus is in any respect the descendant of the philosophy of Plato, it is to the defects of that philosophy alone that it owes its existence. Plotinus uses Plato's term, the Good, for his highest generalization; but he uses it in a wholly different, and even opposite, sense from Plato. The Good with Plato was a synthesis of all that is highest and most excellent in intelligence; with Plotinus it is an abstraction from which every determinate quality is removed; and

there is a corresponding difference in the ethical developments of their systems. With Plato the highest attainment of human morality is the imitation of God through the ideas discoverable by human reason, which he has placed in created things; Plotinus despises all imitation, as well as the things themselves which are proposed to it, and finds the practical aim of his philosophy in the direct union of the human spirit with the deity. It is from a different, though unacknowledged, source that the operative principle of the philosophy of Plotinus is derived. The emanation theory of eastern philosophy, which was first formally combined with Greek philosophy by Philo, had since his time formed an element in various eclectic systems, which had distinctively formed an Alexandrian school; but Philo and his successors did their work like compilers, and it needed a mind of creative energy to weld the elements thus brought together into one. This was accomplished by Plotinus. Another influence, likewise unacknowledged, affected the development of the last great system of pagan philosophy, the growth of Christianity. Plotinus was not, like Porphyry, a violent and open enemy of Christianity. With regard to it, as to oriental philosophy and theology generally, he maintained silence. Even in encountering the Gnostics he opposed their heretical principles without touching those they held in common with orthodox Christians. All Plotinus's treatises are occasional; they are full of repetitions, and his doctrines are not developed in them with any order or method, while the difficulty of understanding them is enhanced by the incomprehensible nature of the doctrine itself.

The highest generalization of Plotinus, which he calls the Good, is a pure undetermined abstraction. It can be described neither as being nor not being, moved nor resting, free nor necessary. Out of this indetermination springs a trinity which is the source of all subsequent being. The original unity, by the excess of its energy, sends forth an image of itself, as the sun emits rays. This image, which is the beginning of plurality and the source of all determinations, also exists absolutely, and is the immediate productive power of the indeterminate unity. Turning with an involuntary movement towards its original in order to behold it, it generates spirit, which is the source of intelligence or thought. Every act of thought directed to the unconditioned produces a real existence, an idea; all these ideas differ in form, but are one in substance. The soul is developed out of the spirit as the idea contained in it; being the immediate product of the spirit, it has a share in all ideas, of which it is itself one. It has, in contradistinction to the spirit, the power of looking out from itself, and thus in imaging the world unites the sensuous with the intelligent. The sensuous is the image of the soul, as the soul is of the spirit. Matter is the lowest boundary of being, the necessary contrast of the good, and in so far negative and evil; but in its susceptibility of form it partakes of the positive and the good.

This hierarchy of being has the beauty of completeness, but it is entirely without evidence, save in the imagination of its author. It differs from Plato in making something anterior to intelligence, and consequently in deriving intelligence from non-intelligence; and in giving soul the power which it denies to spirit, of looking out from itself, it makes the product superior to the producer. Yet this extraordinary system is the result of a severe system of dialectic. Plotinus believed that he followed Plato in making error and imperfection consist in multiplicity and division, and truth in simplicity and unity. Consequently the higher he could go in generalization, the nearer he approached to the source of truth, the primary form of being. Now he found that the conception of being itself was complex, and above that conception stood the conception of unity; but even to name unity was to dissolve it, hence his highest generalization was the unnamable. But the aim of Plotinus was not merely to know but to reach this undefined source of being, of which even being itself could not be predicated. To pursue truth upward to the end would necessarily lead the human mind to its source, but a source above intelligence could not be reached by intelligence; hence new methods had to be invented. Plotinus applied his dialectic to the mind and to the nature of its relation to truth, and in contradiction to the common position of psychology, that the mind can only know itself in some determinate state, he discovered that the human spirit can know itself absolutely, and to the negation of all objects of consciousness. Thinking or meditation, which is the mere act of intelligence, he held to be incompetent to reach unconditioned being, which is grasped only by intuition. Truth accordingly, he held, stands in no need of demonstration. It is comprehended immediately when the spirit sees only itself. In this pure state, to which he gave the name of ecstasy, the Absolute Being gazes upon itself through the medium of our spirits. Porphyry records that Plotinus had succeeded in raising himself to this state four times, while he himself had done so only once. Proclus goes a step further than Plotinus, and announces that the man who raises himself to this condition is God. Thus the final conclusion of a system founded upon the subtlest use of dialectic is to set aside dialectic as unnecessary and useless. The system of Plotinus might be briefly characterized as the suicide of reason, if that description were not of generic rather than specific application in philosophy.

In virtue of this super-rational method the Neo-Platonic philosophy became by eminence the system of mysticism. In default of reason it appealed to imagination, to the love of the unknown and mysterious, and to the ambition so dear to the heart of man. Urged by this new principle of vitality, it sent its shoots across the gulf which separated the rising power of Christianity from the declining cause of paganism, and planted itself vigorously on the other side. But the penalty of evoking vulgar sympathies by this unphilosophic method could not remain unpaid. With mysticism came superstition, the belief in magic, and ignorant theurgical pretensions. Plotinus himself encouraged such beliefs, which allied themselves by a too natural transition with his principles.

The mysticism of Plotinus has a remarkable analogy with the leading doctrines of Christianity as these are developed in the Gospels and epistles of St. Paul and St. John; and as Neo-Platonic mysticism came into combination in subsequent mixed systems with Christianity, it is important to note their points of divergence at their source. Christianity affirms that man cannot by his own efforts attain to direct communion with God, but that God can be known indirectly by his works. Neo-Platonism reverses both the affirmation and the negation. Again, while Neo-Platonism and Christianity both affirm the possibility of a direct communion between God and man, Neo-Platonism establishes this communion through the power inherent in man to rise by abstraction to God; Christianity recognizes its possibility only through the condescension of God in coming down to man, a condescension which is wholly independent of human efforts, and to meet which moral purification is the only possible or fitting preparation on the part of man.

The first complete edition of the Enneads of Plo-

tinus was the Latin translation of Marsilius Ficinus (Florence, 1492), with a faulty Greek text appended. There is an Oxford edition by Fr. Kreuzer, in three vols. 4to, published in 1835; and an edition by Kreuzer and Moser (8vo, Paris, 1855). There are translations of selections of the works of Plotinus by Thomas Taylor, but the works of that translator do not enjoy a high reputation.

PLOUGH. See AGRICULTURAL IMPLEMENTS.

PLOUGH-LAND is an equivalent expression with a hide of land. It is defined as containing as much land as may be tilled in a year and a day by one plough. It is fixed by 7 and 8 William III. cap. xxix., for the purpose of repairing highways, at an annual value of £50. In Scotland the possession of a ploughgate of land is the legal qualification for hunting. The quantity contained in a ploughgate appears to differ in different charters.

PLOUGH MONDAY, the next Monday after Twelfth Day. On Plough Monday the ploughmen in the northern part of England used to draw a plough from door to door, and beg money for drink.

PLOVER (*Charadrius*), a genus of Grallatorial or Wading Birds, forming the type of the family Charadriidæ. The bill is as long as the head, or may be somewhat shorter; it is usually straight, the base being slender, and the tip more or less strongly arched and pointed. The nostrils open at the base, and are situated in a groove or depression extending along one-half of the bill's length. The legs are long and slender, the lower portion of the shin being destitute of feathers. The tarsi are covered with hexagonal scales. The two outer toes are joined by a web at their base; the hinder toe being either wanting, or of very rudimentary nature. The gizzard is large and powerful, and the intestinal cæca are elongated. These birds are gregarious in habits, and occur in marshy spots; but appear to seek the sea-coasts in winter. The eggs are deposited in a hole in sand or gravel, the nest being thus of very imperfect construction; the young being able to run about as soon as they are hatched. The flesh and eggs of the plovers are considered as great delicacies. The sub-family Charadrinæ is constituted for the reception of the True Plovers, together with the Lapwings (which see). These birds occur chiefly in America and in Europe, several species being peculiar to the former continent. The Golden Plover (*Charadrius pluvialis*) is distributed throughout Europe, and also in America. It is the most familiar species, and appears to moult in spring and in autumn also. The American Ring Plovers (*C. semipalmatus* and *C. melodius*); Wilson's Plover (*C. Wilsonius*), also found in America only; the Killdar (*C. Vociferus*), an American species; and the *C. helveticus*, or Black-bellied Plover of Northern Europe and America, are familiar species. The Stilt Plover (*C. himantopus*) is so named from the elongated legs. The British Ring Plover (*C. hiaticula*) is also a well-known member of this group.

The plovers have the habit of patting the ground with their feet in order to attract worms to the surface, and so to obtain them for prey. The name 'plover' is derived from the French *pluvier*, in allusion to these birds appearing in flocks in the rainy weather of spring and autumn.

PLUM (*Prunus*), a genus of plants belonging to the natural order Rosaceæ, sub-order Amygdaleæ. About a dozen species are known, all inhabiting the north temperate regions of the globe. They are small trees or shrubs, with alternate leaves and white flowers, either solitary or disposed in fascicles in the axils of the leaves. The common garden plum (*P. domestica*) does not seem to be a native of Europe, and probably was introduced from Syria. It is mentioned by Dioscorides and Theophrastus, and now is very generally cultivated. It is a robust tree, of middling stature, seemingly adapted to every kind of soil, though most flourishing where it is light and a little sandy. The varieties are very numerous, and differ in colour, taste, size, and form; some are not larger than cherries, while others are nearly 2 inches in diameter; some are oblong or ovoid, and others perfectly globular; the colour is either white, green, yellow, red, purple, blue, or blackish; the taste acid, austere, insipid, sweetish, or aromatic; the consistence of the flesh coriaceous, hard, soft, melting, dry, or watery; all, however, have a smooth skin, which is always more or less covered with a fine whitish dust, easily removed by rubbing. The most esteemed of all these varieties is the green gage, or *Reine Claude*. (See GREEN GAGE.) The Washington plum is similar to the green gage, but the skin is dull yellow, assuming an orange cast on the side exposed to the sun, and is more or less mottled with crimson dots; the flesh is yellow, firm, very sweet, and luscious, and separates freely from the stone. Almost all the varieties of plums may be dried and converted into prunes, but those which are most fleshy, and best retain their quality, are preferred. Prunes now form a considerable article of commerce, and are imported chiefly from France. Plums may also be preserved in various manners, in spirits of wine or sugar, or formed into marmalade, jellies, &c. The wood of the plum-tree is hard, compact, traversed with reddish veins, and susceptible of a fine polish. It is frequently employed by turners and cabinet-makers. The sloe (*P. spinosa*) is a thorny shrub, growing wild in most parts of Europe, and bearing a small, round, and nearly black fruit of an extremely austere taste. The juice of this plum is frequently employed to communicate a red colour and astringent flavour to wines.

PLUMBAGO, or GRAPHITE, names applied to several varieties of native carbon containing from 95 to nearly 100 per cent. of that element. Plumbago has an iron-black or steel-gray colour, a metallic lustre, and produces a black, shining streak on paper. The specific gravity of this mineral is about 1·2; it is a remarkably good conductor of electricity. There are two leading varieties of graphite: (1.) *Crystallized* or *foliated*, which is found in small six-sided tables in Ceylon, Australia, New York State, &c. This variety is produced in the cooling of molten iron, when part of the carbon rises to the surface in crystalline forms. (See description of Pig-iron under IRON.) (2.) *Amorphous*, which is without crystalline structure, and is softer than the crystalline variety. It leaves a much blacker streak on paper. It is largely used, under the name of *black lead*, for making pencils. Considerable quantities of amorphous graphite are found in Cumberland, near Passau, and in the Ural Mountains.

PLURALITY, in ecclesiastical law, signifies the holding by the same person of two or more benefices. Pluralities were forbidden by the canon law, but the bishops and the pope assumed the right of granting dispensations to hold them. They were prohibited by the Councils of Chalcedon (451), Nicæa (787), and Lateran (1215). In England they were prohibited by act 21 Henry VIII. cap. xiii. and 57 George III. cap. xcix. By 1 and 2 Vict. cap. cvi., and 13 and 14 Vict. cap. xcviii., it is enacted that in future, and subject to vested rights, no spiritual person shall take and hold together any two benefices, except in the case of churches within 3 miles of each other by the nearest road, and the annual value of one of which does not exceed £100; that no spiritual person having a cure of 500 souls shall take another with more than 3000, or having a cure of 3000 souls,

shall take another with more than 500; that no spiritual person holding more than one cure of souls shall take and continue to hold therewith any other cure or any cathedral preferment; and that any admission to a benefice or preferment in violation of this enactment shall be *ipso facto* void. The prohibitions in respect to yearly value and population are subject to dispensation in certain cases by the Archbishop of Canterbury on the recommendation of the bishop of the diocese. The acts 18 and 19 Vict. cap. cxxvii., and 23 and 24 Vict. cap. cxlii., which provide for the union of contiguous benefices, contain further regulations affecting pluralities.

PLUS (more), in mathematics, signifies addition; the sign by which it is indicated is +; thus A+B, which is read A *plus* B, denotes that the quantity A is to be added to the quantity B. Plus, or its sign +, is also used to indicate a positive magnitude or relation, in opposition to *minus* −, which indicates a negative.

PLUSH, a species of cloth of a description similar to velvet, from which it differs only in the length of the nap, which in velvet is cut short, while in plush it is made long, flat, and glossy. Plushes are made in as great variety as velvets, both in texture and material. Cotton, wool, silk, goats' hair, swans' down, &c., are used in their fabrication. The nap may be formed either in the warp or woof, the one in which it is being double, there being a warp and a woof for the body of the cloth, and a warp or a woof for the nap. Plush for hats is largely manufactured in France; it is formed of a warp of unbleached silk with a cotton woof and a nap of dressed silk. France supplies nearly the whole of Europe with this fabric. The manufacture of silk-plush for hats was first introduced in Rhenish Prussia, but the improvements of a Lyons manufacturer, J. B. Martin, whose first patent was dated in 1833, revolutionized the trade and transferred its seat to France. The inventor himself extended the manufacture by the founding of new establishments to the departments of Rhone, Loire, Isère, Meurthe, and Moselle (Metz). The house of J. B. Martin has thrice received the decoration of the Legion of Honour—in 1855, 1867, and 1874, the last time on the occasion of the Vienna Exhibition.

PLUTARCH (*Ploutarchos*), a learned and prolific Greek writer, born at Cheronæa in Bœotia. He studied philosophy under Ammonius, a peripatetic philosopher of Attica, in A.D. 66, which is the only indication of his age. He appears from his writings to have visited Italy, lectured there on philosophy, and stayed some time at Rome, where he lectured during the reign of Domitian. He is said on doubtful authority to have been the preceptor of Trajan. He spent his later years at Cheronæa, where he had a priesthood and a magisterial office. The time of his death is unknown. His Parallel Lives of illustrious Greeks and Romans is the work to which he owes his fame. The lives are written in pairs, one Greek and one Roman, followed by a comparison of the two, which in some instances is wanting, and a few of the Lives themselves are lost. In these Lives Plutarch is said to have quoted 250 authors, the works of many of whom are lost. His Lives are chiefly intended for the illustration of character, and as he makes use of incidents for this purpose without regard to their relative value, his Lives are only partially serviceable for historical purposes. In the arrangement of his incidents he does not always follow a chronological order. Their excellence consists mainly in their fidelity in biographical portraiture. A Latin collection, consisting of translations made by different persons of the separate lives, was printed in Rome in two vols. folio in 1470. The first edition of the text was printed in Florence in 1517. An edition by Bryan, with a Latin translation (completed after his death by Du Soul), was published in five vols. 4to in 1729. There is an edition by A. Coraes (Paris, 1809–15), and one by C. Sintenis (Leipzig, 1839–46, four vols. 8vo). There is a good French translation by Amyot, a German translation by Kaltwasser; there are English versions by Thomas North, from Amyot's French (London, 1579), called by Wharton 'Shakspere's storehouse of learned history;' by Evelyn, Garth, Creech, &c., with a life by Dryden (five vols. London, 1683–6); and by John and William Langhorne (six vols. London, 1770, with several subsequent improved editions). The translation called Dryden's was corrected and revised by A. H. Clough, and published in 1859, in five volumes. George Long has translated and annotated some of the Lives. Plutarch's other works are about sixty in number; they are generally classed as *Moralia*, though some of them are narrative. Wyttenbach's edition of the Moralia was published at Oxford in eight vols. 4to (1795–1810). Philemon Holland executed an English translation of the Morals (1603), and there is also a later translation by several hands. An edition of all the works of Plutarch, by J. C. Hutten, appeared at Tübingen (1791–1805) in fourteen vols. 8vo. The name Plutarch is often given to a collection of lives of distinguished men. Such collections exist not merely in English, but also in French, Italian, Russian, German, and Swedish.

PLUTO, in Greek mythology the giver of wealth, or HADES, the god of the lower world. The former name gradually superseded the latter, which was more commonly used by the poets. He was the third son of Cronus and Rhea, a brother of Zeus (Jupiter) and Poseidon (Neptune), and to him, on the partition of the world, fell the kingdom of the shades. He married Persephone, the daughter of Demeter. Sacrifices of black sheep, male and female, were offered to these deities. Under the surface of the earth he is enthroned as the ruler of the dead. As far beneath his habitation as the heaven is above the earth, lies Tartarus, the access to which is by a gate guarded by himself; thither, after death, must all men descend. Powerful, terrible, inflexible to prayers or flattery, is the dark-haired god. Heracles, however, carried off his dog, the fearful Cerberus, who lies before Pluto's dreadful abode. He rides on a chariot drawn by four black horses, which he guides with reins of gold. His helmet makes the wearer invisible. So says the Iliad. The Odyssey gives a somewhat different account. It does not explicitly place his habitation beneath the earth. Ulysses sailed from Ææa with a north wind, passed over the ocean, and landed near the lofty rocks and the grove of Persephone, where the Cimmerians dwell in everlasting night. Having arrived there he proceeded along the ocean until he reached the nocturnal darkness, the abode of Aïs (Hades), where dwell the dead. But according to Hesiod, on the western margin of the northern hemisphere, wrapped in eternal darkness, one cleft in a cavity under the surface of the earth leads down to the dead, another to Tartarus. Yet both of these subterranean abysses are mentioned by him under the latter name. Homer, and those poets who followed next after him, described the realms of Hades as being under the surface of the earth, where the dead, like the living on earth, good and bad, dwell together, and a few enemies of the gods alone suffer torments; Tartarus was a distinct region. But as philosophy, by bolder conjectures concerning the surface of the earth, and finally by the doctrine of a floating sphere, did away the old notions of Tartarus, and as the belief of a future retribution gained ground, the realms of the dead, placed at first under the surface of the

earth, and then by some in the centre, were separated into Elysium and Tartarus. These changes had also an influence on the notions entertained respecting the sovereign of the lower world. He not only gained in outward power and supremacy, but the conceptions of his character were changed; he became a benevolent being, who held in his hand the keys of the earth, and blessed the year with fruits; for from the abyss of night come all riches and plenty. It is therefore not strange that the later ages, confounding Hades with Plutus, called him Pluto, and attributed to him dominion over the treasures concealed in the bowels of the earth. He fought with his brothers against the Titans, and received from the Cyclopes, whom he had released, the helmet that makes its wearer invisible, which he lent to Hermes in the war of the giants, and to Perseus in his expedition against the Gorgons, and which afterwards came into the possession of Merions. The Furies, who are said to be his daughters, and Charon are his ministers. He judges every open and secret deed, and to him are subordinate the three judges Æacus, Minos, and Rhadamanthus. Bacchus, Heracles, Orpheus, and Ulysses entered his realms alive, and left them uninjured; but Theseus and Pirithous, whose object is said to have been the abduction of his wife, he caused to be chained, though the former is said to have been subsequently released by Heracles. The worship of Pluto was extensively spread among the Greeks and Romans. The cypress, the box, the narcissus, and the plant adiantum (maiden-hair), were sacred to him: oxen and goats were sacrificed to him in the shades of night, and his priests were crowned with cypress. He is represented in gloomy majesty, his forehead shaded by his hair, and with a thick beard. His head is sometimes covered with a veil. He frequently also wears his helmet, or a crown of ebony, or a wreath of adiantum or narcissus. In his hand he holds a two-forked sceptre, a staff or a key; by his side is Cerberus. He is either seated on a throne of ebony or in a chariot.

PLUTUS, son of Iasion and Demeter, was the god of riches. His genealogy shows the meaning of the allegory, which is merely this, that 'Agriculture produces wealth.' At first Plutus had the use of his eyes, but Zeus struck him blind because he confined his gifts to the good; and he thenceforth conferred them equally on the good and the bad. His residence was under the earth. He is weak, and limps when he comes to mortals, but swift-footed or winged when he leaves them. Fortune carries him in her arms, and he also forms one of Athena's retinue. He is sometimes confounded with Pluto.

PLUVIOSE, one of the months of the French Republican calendar. See CALENDAR.

PLYMOUTH, a seaport town, municipal and parliamentary borough of England, in the county of Devon, on the Sound of same name, between the estuaries of the Plym and Tamar, and at the terminus of the South Devon Railway, 36 miles south-west of Exeter, 44 by road and 53 by rail. The London and South-Western Railway has recently brought its system into Plymouth, and has erected a terminal station at Devonport. Taken in its largest sense, it comprehends what are called the 'Three Towns,' or Devonport on the west, Stonehouse in the centre, and Plymouth proper on the east; but as the first is described under its own name, and includes the second in its parliamentary borough, the present article refers only to the third. Taken in this restricted sense, Plymouth covers an area of about 1 square mile, bounded by the Sound and Catwater Harbour on the south, and extending from Mill Bay on the west to the mouth of the Plym on the east. The site is uneven, and somewhat rugged, consisting of a central hollow and two considerable eminences, one on the north, forming the suburbs, and the other, called the Hoe, on the south, laid out as a promenade and recreation ground. The older parts of the town consist of narrow and irregular streets, devoid of architectural beauty, and often steep and winding. But in the newer parts and suburbs many handsome terraces and detached villas have been erected. Among others may be specified the noble pile of houses forming the esplanade and Elliot Terrace on the Hoe. The market-place, near the centre of the town, is approached by three principal entrances, and though irregular in shape, has an extent of nearly 3 acres. The public buildings include the two parish churches of St. Andrew and Charles the Martyr; Sherwell Congregational chapel, the Roman Catholic cathedral; the citadel, on a bold headland, built chiefly of limestone and granite, and flanked by three regular and two irregular bastions; the Royal Hotel and theatre, an elegant pile of buildings in the Grecian style; the post-office, on the model of a temple of Vesta at Tivoli in Italy; the guildhall, opened in 1874, a handsome Gothic building; the custom-house, a large and handsome granite structure; the exchange, the athenæum, the mechanics' institute, the Plymouth and Cottonian public library, containing 10,000 volumes, and a collection of original drawings, prints, and articles of *vertu*, the Grammar, Free, National, and various other endowed schools; the Western College, or Congregational Theological Seminary; the Public Dispensary, Female Penitentiary, Eye Infirmary, South Devon and East Cornwall Hospital, recently erected, &c.

The manufactures include soap, sail-cloth, brushes, Roman cement, earthenware, rope and twine, &c., and there are also building-yards, foundries, two sugar-refineries, breweries, starch-works, and flax, saw, and flour mills, together with limestone quarries. The fisheries, chiefly of whiting, hake, and mackerel, are very productive. The trade also, both coasting and foreign, is very important. Steamers ply regularly to North America, the Cape, Australia, New Zealand, the West Indies, &c. The parts of the port chiefly appropriated for mercantile shipping are Sutton Pool and Mill Bay, particularly the latter, where there are extensive wet-docks, and the largest vessels lie in safety along its fine pier and pontoon even at low water. The number of vessels that entered the port in 1882 was 3689 of 802,985 tons; and the number cleared 3336 of 738,245 tons. But Plymouth owes its celebrity not so much to these as to its importance as a great naval station, for which the spaciousness of its Sound, and the depth of water retained by its arms after penetrating far into the mainland, render it admirably suited. The Sound, however, about 3 miles wide at its mouth, being open to the south-west winds, left vessels at anchor exposed to the greatest danger. With the view of protecting the anchorage from the heavy swell of the Atlantic, the stupendous national work, known by the name of the Plymouth Breakwater, was undertaken, and was finally completed at an expense of about £2,000,000. It consists of a central body of 1000 yards, and an arm or kant at each extremity, of 350 yards, making the whole length only 60 yards short of a mile. The height is from 56 to 80 feet, the top 45 feet broad, and from 2 feet to 3 feet above the high-water of spring-tides, and the contents of the whole mass amount to 3,670,440 tons of limestone, together with 2,512,696 cubic feet of granite, and other stone used in paving and facings. On the west end of the breakwater a lighthouse, 68 feet above the platform, and visible at the distance of 8 miles, except in foggy weather, has been erected,

but the entrance into the Sound is guided by the still more celebrated Eddystone lighthouse, which stands on a large cluster of rocks in the channel opposite to it. To defend the port an iron-cased fort has been built near the breakwater, and St. Nicholas, or Drake's Island, within the breakwater, and connected with the south-west shore by a range, or as it is called Bridge of Rocks, uncovered at low-water, has been furnished with strong fortifications, mounted with 25-ton Armstrong guns.

Plymouth, originally a fishing village, bore under the Saxons the name of Tamarworth, which, after the Conquest, was changed to that of Sutton, or South Town. It had been a considerable town under its present name in 1438, when a charter, confirming its old and granting many new privileges, was conferred upon it by Henry VI. From Elizabeth it obtained a new charter through the solicitation of Sir Francis Drake, of whom a handsome statue was erected on the Hoe in 1884; and on the threatened invasion of the Armada equipped as its quota to the British fleet, which had here its rendezvous, seven ships and a fly-boat, a greater number than was furnished by any port except London. George III. with his queen visited it in 1789, and Bonaparte arrived here in the *Bellerophon* in 1815. Plymouth is governed by a mayor, twelve aldermen, and thirty-six councillors, and sends two members to the House of Commons. Pop. (1881) of mun. bor. 73,794; of parl. bor. 76,080.

PLYMOUTH, a post-town, port of entry, and shire town of Plymouth county, Massachusetts, formerly the capital of the Plymouth colony, and the oldest town in New England. It was settled by the pilgrims who arrived in the *Mayflower*, December 22, 1620. It stands on a fine harbour of the same name, 36 miles S.S.E. of Boston. The principal buildings are the court-house, jail, and nine churches. The bay is spacious, but shallow, and the harbour secure, though difficult of access. The town has considerable commerce and valuable manufactures of iron. An elegant hall has been erected for the use of the Pilgrim Society, and a portion of the rock on which the pilgrims landed has been erected in front of it. Population, 7093.

PLYMOUTH BRETHREN, a sect or association of Christians which arose in England about 1830, and took its popular designation from the town of Plymouth, in which it first began to flourish. The rise of this body appears to have been partly spontaneous, partly due to the labours of John Darby, first a barrister, then a clergyman of the Church of England, and subsequently a Dissenter, the coincidence of whose views with that of some sectaries of Plymouth supplied the denominational basis, from which the sect spread itself with considerable rapidity, gaining numerous adherents in England, on the Continent of Europe, particularly in Switzerland, France, and Italy, and in the United States of America. Darby separated from the Church of England specially on the ground of scruples in regard to apostolical succession. To theological views strongly tinctured with mysticism he united communistic views of church organization, which, however, were arrived at as the result of a peculiar process of reasoning rather than adopted for their own sake. He appears to have held that apostolical succession was the true foundation of church organization, but that it was actually lost. The church therefore as a corporation had, like the Israelites as a nation, been rejected of God on account of its declension from the truth. There remained only the voluntary association of Christians among themselves, and in their meetings the Plymouthists insist upon the equality of all the male members, and their right to exhort each other, especially when moved by the Spirit; and after the opening services, consisting of a hymn or prayer, a pause is usually made to wait for voluntary addresses. Darby carried on for many years an active propagandism in favour of his peculiar theories, and at first with an extraordinary measure of success; but what seemed at first to be a movement great enough to threaten the whole organization of the Christian church was soon effectually checked by internal dissensions among his followers themselves. Darby soon formed a congregation of 700 or 800 disciples in Plymouth, and having established similar associations in London, Exeter, and other places, he commenced missionary operations on a large scale. He himself frequently visited every part of Europe, presiding at meetings, and preaching in English, French, and German, while others carried the principles of the new sect to America and India. A journal, the Christian Witness, was also established in its interest, to which Darby was one of the chief contributors. The principal sphere of Darby's labours on the Continent was the Canton de Vaud in Switzerland, where he resided for a considerable time, and made numerous converts. His followers on the Continent are usually called Darbyites.

The Plymouth Brethren distinctly repudiate being a sect, and decline the distinctive designations given them, calling themselves simply Christians or Brethren; but their separate organization, however loose it may be, makes it impossible to relieve them of the necessity of having a separate designation. They recognize no creed, and it would probably be hazardous to give them one; but as they have split up into sections on theological differences they cannot be regarded as indifferent to the opinions held by those with whom they associate. In general their views may be held to be a compound in various proportions of Calvinism and mysticism. The point on which they split in Plymouth was a doctrine regarding the human nature of Christ propounded by one of their teachers called Newton, which Darby regarded as a dangerous error. This produced a threefold division, the adherents of Darby and Newton being in direct antagonism, while a third party, represented by the celebrated George Müller, declined to join either party. The Plymouth Brethren professedly model themselves upon the primitive church, and at an early stage of the movement there was a tendency towards the adoption of the principle of community of goods. They also, in general, hold millennarian views, and Darby is exceedingly minute in carrying out the allegorical interpretation of the ceremonial, and other figurative parts of the Old Testament. The interpretation of prophecy, as filling up in detail the entire rôle of history, is another peculiarity of Darby and the Plymouthists. They baptize adults and administer the sacrament, which each takes for himself, each Sunday. At their meetings a pause of unbroken silence ensues when no one is moved to speak. They hold both civil governments and ecclesiastical organizations to be under divine reprobation, the former as atheistic, the latter as in a state of apostasy.

PLYMOUTH SOUND, an arm of the sea, on the south-west coast of England, between the counties of Devon and Cornwall. It is about 3 miles wide at its entrance, bounded by elevated land, which descends abruptly to the sea. It contains Drake Island, which is fortified; and Eddystone Lighthouse lies 11 miles below the breakwater. See PLYMOUTH.

PNEUMATIC DESPATCH. In our article ATMOSPHERIC RAILWAY we have given an account of the early attempts made to adapt the principle of atmospheric propulsion to special applications of the

system of conveying goods and passengers by lines of rails. Although these attempts have hitherto proved abortive in respect to the conveyance of passengers and heavy goods, this means of propulsion has been successfully applied in the case of large parcels, and a very important development of it has taken place in regard to the internal transmission of telegrams in large towns.

After various experiments, begun in 1861, a Pneumatic Despatch Company formed in London, and which had worked for some years a more restricted system, opened on November 7, 1866, the first portion of a system of communication for the conveyance of mail bags, &c., between the General Post-office and the North-Western Railway, Euston Square. This system, which is in two parts, is worked from a central station in Holborn. The length of the tube from Holborn to Euston Square is 3080 yards, that between Holborn and the Post-office is 1658 yards. Both the tubes open into the station, which is situated at right angles to them, and through trains have to be reversed in transferring them from one line to the other. This is done by running the arriving train by means of its momentum up a short incline on to a turn-table, where it is put in communication with the other line and descends by gravity. This is effected in thirty seconds. The tube forms a section in the shape of a flattened horse-shoe, or letter D lying on its straight side. It is 5 feet in width and 4 feet 6 inches in height at the centre. The carriages, which are technically called *carriers*, are of the same shape as the tube, but of a slightly smaller area, a flange of india-rubber surrounding the carrier so as to make it form a piston, but in practice it is not found necessary that the piston should be perfectly air-tight. Two gradients of 1 in 15 occur in one of the lines, which do not interfere with its working. Those in the other are much easier. The sharpest curve has a radius of 70 feet. The straight portions of the tube are made of cast-iron, the curved portions of brickwork lined with cement. The currents by which the carriages are propelled are created by a fan 22 feet 6 inches in diameter, which is put in rotation by a steam engine with a pair of 24-inch cylinders, with 20-inch stroke, geared so that one revolution of the engine gives two of the fan. The trains are propelled from the central point by pressure, and drawn to it by exhaustion. The necessary changes of the current are produced from the continuous working of the fan in one direction through the intervention of valves.

The application of the principle of the pneumatic despatch to the internal transmission of telegrams has been necessitated by the growth of the telegraph business. The messages received, whether for transmission or delivery in London and other large cities, have to be collected or distributed through a number of district offices. The two principal means of collection and distribution previous to the introduction of the pneumatic despatch were by messengers or conveyances, and by telegraphic communication between the district and head offices. The former method was too slow and the latter both lost time through the accumulation of messages and occasioned an additional risk of error from the necessity it involved of repetition of the message. The Electric and International Company first adopted the pneumatic system on the principle already described of alternate pressure and exhaustion. This system, introduced by Messrs. Latimer, Clark, and Varley, required a separate tube between each pair of stations, and admitted of only a single despatch at a time. It has hitherto been most used in Great Britain, but a system of laying tubes in circuit for the continuous transmission of despatches, by means of an uninterrupted air-current in one direction, was adopted in Berlin by Messrs. Siemens and Halske in 1863, and introduced by the inventors in London in 1870. A circular system, but not with a continuous current, is also in use in Paris; and as the pneumatic despatch has here been carried to its greatest development, a description of the working of the Paris system will best illustrate its practical utility. There are fifty stations, at distances of about a kilometre (1093 yards) apart, connected by an iron tube interrupted at each station. The diameter of the tube is about 2 feet. The central station is in the Rue de Grenelle, and is connected with seventeen district stations, and there is a secondary net-work, besides a direct line for facilitating the transmission of expresses. The means of propulsion is compressed air, prepared at the different stations. The trains are divided into two classes—omnibus trains, which stop at intermediate stations, and expresses, which go direct to their destination. An omnibus train leaves the Rue de Grenelle every quarter of an hour, and makes the circuit, returning to the station from which it started in twelve minutes. Express trains to the busiest stations are intercalated between the omnibus trains. A separate box is put in the omnibus train for each station with messages to be transmitted. This is taken out at the station and another substituted with messages for despatch, so that the train returns with as many boxes of despatches as were sent out.

Various means are adopted of exhausting or compressing air for the use of the pneumatic despatch. The simplest and least expensive means of exhaustion yet discovered is the expulsion of the atmospheric air by the direct admission of a jet of steam. The speed of the carrier is uniformly found to be greater as it approaches the vacuum end.

PNEUMATICS, the science of gases, is a branch of hydrodynamics, the science of fluids generally. The principles of static pneumatics, that subdivision of the subject which deals with gases at rest, are comparatively well known. It is difficult in investigating the kinetic phenomena of gases to eliminate viscosity or internal friction, and as in the kinetics of fluids generally, experiments have merely led to empirical rules upon which indeed theories may be built, but these theories are only used as guides by experimenters. Viscosity or molecular friction is noticeable in solids and fluids; but when the effects of forces on solid bodies are investigated, the mathematical treatment of the subject, the bodies being regarded as rigid, and therefore as having no internal friction, leads to laws which agree very closely with observation and experiment. But the observed phenomena of fluids are those in which viscosity plays a most important part, and the science is not advanced enough for any but a very incomplete mathematical treatment. Professor Clerk Maxwell's theory of molecules (see GAS), and his experimental investigations of viscosity, Mr. M'Farlane's experiments on the viscosity of solids, Sir William Thomson's theories of vortex motions and magnetism, supported by Faraday's experiment of the rotation of the plane of polarization of light, &c., and other investigations in physics, will, no doubt, lead in time to a satisfactory knowledge of molecular kinetics. The subject has intimate relations with magnetism, light, heat, and electricity. At present in dealing with practical questions, the flow of fluids in channels, centrifugal pumps and fans, turbines, screw and other marine propellers, &c., scientific men depend firstly on the great law of conservation of energy, and secondly on the results of special experiments.

Gases at rest transmit pressure freely in all directions. They have weight, so that in a mass of gas under gravitating force the pressure increases downwards. The experimental determination of the weight

of the atmosphere surrounding the earth is fully explained in the articles BAROMETER, AIR, ATMOSPHERE. It is found that near the level of the sea every surface exposed to the atmosphere sustains a normal pressure equal on an average to the weight of a column of mercury whose base is this surface and whose height is 30 inches, or to the weight of a column of water whose height is about 34 feet. This is the maximum height to which water can be raised in a pump, as was observed by Galileo. The pressure of a gas; the relations between pressure and volume in a given quantity of gas; the relations between gases, vapours, and liquids; and other important phenomena, which are usually treated of in works on pneumatics, will be found in the articles just referred to, and also in AIR-PUMP, PUMP, MANOMETER, PRESSURE, METEOROLOGY, MATTER (CONTINUITY OF THE STATES OF).

PNEUMONIA (Greek, a disease of the lungs, from *pneumōn*, lung), acute inflammation of the lung substance. It is generally ushered in by restlessness and febrile symptoms, succeeded in a short time by shiverings or rigors. These are followed by acute pain in the affected side, distressed breathing, a high pulse, an increased temperature of the body, a distressed and anxious countenance, and a livid appearance of the skin, due to the blood not being properly oxygenated. There are also headache, great thirst, loss of appetite, severe prostration, and painful cough, which in a few days is accompanied by a rust-coloured expectoration. The base of the lung is the portion of the organ which is most generally attacked, and the right lung is twice as often affected as the left. Pneumonia is a disease which is seldom fatal if it is detected in time and is judiciously managed. The most important points to attend to are the following:—To keep the patient quiet in bed in a well-ventilated and moderately-warm room, to see that the bowels are gently moved, the application of hot poultices, or in some instances a fly-blister over the affected part, the administration of a simple yet very nourishing, and in some cases a stimulating diet, and medicines which tend to promote a free action of the skin and reduce fever.

PO (anciently *Padus* or *Eridanus*), the largest river of Italy, in respect both of its length and its volume of water, and hence styled by the Italians the Father or King of Rivers. It rises on the confines of France and Piedmont in Mount Viso, one of the Cottian Alps, and flows rapidly eastward through Piedmont in the character of a mountain torrent, till, after having been augmented by several other mountain streams, it reaches Lombriasco. Here it begins to be a majestic stream, and, turning northward, passes Turin. Shortly after it assumes an easterly course, and reaching the confines of Lombardy is greatly augmented in volume by the accession of the Ticino on the left. Here, still continuing eastward, it forms the boundary between Lombardy and the Emilian Provinces till about lon. 10° 40′ E., where it turns northwards and then eastwards through Lombardy. About lon. 11° 15′ it meets the Venetian frontier, after which it separates first Venetia and Lombardy and then Venetia and the Emilian Provinces. It afterwards throws off several branches, and finally, dividing into two principal arms, enters the Adriatic by two mouths about 12 miles distant from each other, the larger and northern arm taking the name of Po-di-Maestra, and the smaller but most frequented that of the Po-di-Goro, which continues the boundary-line between Venetia and the Emilian Provinces. Its principal affluents are, on the left, the Clusone, Sangone, Dora-Riparia, Stura, Dora-Baltea, Sesia, Agogna, Terdoppio, Ticino or Tessin, Olona, Lambro, Adda, Ollio, and Mincio; on the right, the Vraita, Tanaro, Scrivia, Trebbia, Nura, Taro, Parma, Enza, Secchia, and Panaro. Its direct course, almost due east, is 270 miles; its total course, including windings, about 450 miles. After the first 60 miles it begins to be navigable by small barges, but its navigation throughout meets with numerous interruptions. After receiving the Adda its average breadth is about 650 yards. Below Piacenza, which it passes on the right about lon. 9° 40′ E., it is confined by artificial embankments, which are said to have originated with the ancient Etruscans, and notwithstanding the immense sums which have been expended upon them, and the engineering skill which has been exerted in order to render them perfectly secure, the most disastrous inundations have repeatedly taken place. The embankments themselves have in one sense added to the danger. The deposits made by the river are perpetually tending to raise the level of the water. This makes it necessary to make a corresponding increase in the height of the embankment, and the effect of these combined operations has been to lift the river so high above its natural bed that it is actually on a level with the tops of the houses in the city of Ferrara. The Po is well supplied with fish, including, among others, the shad, salmon, and sturgeon. The last is not fished in any other river of Italy.

POA. See MEADOW-GRASS.

POACHING, a non-legal term applied to the stealing of game or the entering on another's fishery without leave for the catching of fish. For the law relating to the poaching of game see GAME LAWS. With regard to private property in fisheries, according to the law of England, there can be such a thing only in the case of streams where there is no ebb or flow, ponds wholly inclosed by a person's land, and lakes bordered by the property of different persons, unless the exclusive right of fishing in a public river, that is, one in which there is ebb and flow up to the tidal limit, or a portion of the sea, has been granted to a person's predecessors by royal franchise at least as early as the reign of Henry II. Such is the law of the Magna Charta, which deprived the crown of the right of conferring such franchises in future, although it continued all such as had not been conferred subsequently to the date mentioned. When a person claims the privilege of an exclusive fishery in a portion of the sea or a public river, it falls upon him to prove his right; but if he can prove that such right has been enjoyed by his predecessors for 200 years it will be assumed that it dates from the reign of Henry II., and the right will be admitted. When a person's land adjoins a stream where there is no ebb and flow that person is assumed to have an exclusive right to fish in the stream as far as his land extends, and up to the middle of the stream; and any person who claims the right of fishing in that part of the stream, either as an exclusive right against the proprietor of the land on the bank as well as all others, or as a right which he enjoys in common with others (a common of piscary), is required to prove his right. It has been doubted whether there can be an exclusive right of fishing belonging to one person when the land on the banks of a stream belongs to another; yet it seems to have been established that such a right may be acquired by a grant or demise immediately from the owner of the soil. When a person's property adjoins both banks of a stream that person is of course assumed to have the exclusive right of fishing in the whole breadth of the stream. So also when a person's land incloses a pond, the fish in that pond belong to him. Where several properties are contiguous to the same lake the right of fishing in that lake belongs to the proprietors, although it is often a difficult matter to say how that right is

divided among them, a good deal depending on the title of each proprietor. In any case the public have no right to fish in such lake even when it is bordered at some part by a public road. In England there is no special law as to the property in salmon fisheries. Every person who has a right to fish in any sea or stream has the right to fish for salmon as well as for any other fish, subject, of course, to the regulations as to seasons and means contained in the Salmon Fishery Act. The law as to poaching in private fisheries is contained in the twenty-fifth section of the Larceny Act (24 and 25 Vict. cap. xcvi.), where it is declared that any person not being an angler who shall take or destroy, or attempt to take or destroy, any fish in any fishery which is private property, but not in land belonging to the dwelling-house of the owner of the fishery, shall forfeit, in addition to the value of the fish, any sum not exceeding £5; and if the fishery is in land belonging to the dwelling-house of the owner, a person not an angler unlawfully and wilfully taking and destroying fish from it shall be guilty of a misdemeanour. Such a fish-poacher, when caught in the act, may be arrested by anybody; but if he escapes to the highway he can only be summoned before justices in the ordinary way. If arrested in the act he must be taken before a justice within a reasonable time, and charged with the offence. Although he may be arrested in the circumstances mentioned a fish-poacher cannot be deprived of the fish which he may have caught. Anglers pursuing their sport during the day-time on other persons' property are more mildly dealt with. They cannot in any circumstances be arrested, and even when summoned before a justice and convicted of the offence are not liable to so severe penalties as other poachers. If they have been angling within the land belonging to the dwelling-house of the owner of the fishery they are liable to a penalty not exceeding £5, and in other circumstances to a penalty not exceeding £2. If found angling in another's fishery an angler, although he cannot be arrested, may be deprived by the owner or his servant of his fishing implements; but in this case he is liable to no further penalty. The same law as obtains in England with regard to fisheries and poaching of fish applies also to Ireland, except as to property in oyster-beds, for the law relating to which see OYSTER.

In Scotland the law as to property in fisheries, as well as the poaching of fish, is considerably different from English law. There salmon are in both respects distinguished from all other fish. As to property in salmon fishings that is held to be originally vested in the crown, not only for the rivers of Scotland but also for the coasts round Scotland, and no person accordingly is allowed to fish for salmon unless he possesses a grant or charter from the crown enabling him to do so. The fact is, however, that nearly all the great landed proprietors do possess such rights with reference to the waters which are inclosed in, which run through, or are contiguous to their lands. When the right of salmon-fishing is in the hands of several persons for the same river, none of those exercising the right can use any fixed engine for catching salmon, but must use the net and coble. There are special statutes regulating the salmon-fishings in the Tweed, Solway, and the rivers flowing into these, as also for some other rivers, but these do not differ materially from the law which generally prevails. As to other fish than salmon the right of fishing for them, as a general rule, belongs to the owner of the land on the banks. The punishment for poaching salmon in Scotland in 'any river, stream, lake, water, estuary, frith, sea, loch, creek, bay, or shore of the sea, or in or upon any part of the sea within 1 mile of low-water mark,' is a fine fixed by act 7 and 8 Vict. cap. xcv. at not less than 10*s.* nor more than £5, together with the forfeiture of the fish taken, and the boat, tackle, &c., employed by the poacher, if the sheriff or justice think fit. Any one not an angler poaching trout or any other fresh-water fish renders himself liable to a penalty of £5, besides forfeiting the fish caught. If he be caught in the act of using a net for poaching such fish he may be arrested, but not unless; but even when he may not be arrested his boat and fishing implements may be seized, unless he is fishing with an angling-rod. A person who merely angles for trout in places where he has not got leave to fish can neither be arrested nor deprived of his fishing implements, nor be punished by any penalty, but is merely liable to an action at law.

POCAHONTAS, daughter of Powhatan, a celebrated Indian warrior in Virginia, was born about the year 1595. She discovered the warmest friendship for the English, who colonized Virginia when she was about twelve years old, and was eminently useful to the infant settlement. The first remarkable evidence of this attachment was displayed in 1607, when Captain John Smith was taken prisoner by her countrymen, and brought before Powhatan that he might put him to death. As the savage lifted his club to dash out the brains of the prisoner, whose head was laid on a stone at his feet, Pocahontas threw herself on Smith's body, and prevailed on her father to spare his life. Captain Smith was suffered to return to Jamestown, where he sent presents to Powhatan and his benefactress. From this time Pocahontas frequently visited the settlements of the whites, to whom she furnished provisions at times when they were particularly needed. In 1609 Powhatan invited Smith to pay him a visit, promising him a supply of provisions, but designing to entrap and destroy him and his party. Pocahontas, becoming informed of this plot, ventured through the forest at midnight to disclose it to Smith. After Smith had left the colony in 1612 she fell into the hands of an English expeditionary party, who kept her as a valuable hostage. During her detention Mr. Rolfe, an Englishman, became attached to her, and offered her his hand. It was accepted, and the consent of Powhatan being obtained, the marriage was solemnized in presence of the uncle of Pocahontas and her two brothers. This event relieved the colony from the enmity of Powhatan, and preserved peace between them for many years. In the year 1616 Pocahontas embarked with her husband and several Indians of both sexes for England, where she was baptized, exchanging her Indian name for that of Rebecca. In the following year (1617), while about to embark at Gravesend, in company with her husband and an infant son, to revisit her native land, she died, of grief, it was said, at having discovered Smith, to whom she was much attached, and whom she thought to be dead, to be still alive. She left one son, who was educated by his uncle in London, and whose descendants are still said to exist in the state of Virginia. Such is the romantic tale that is usually told of Pocahontas, but E. D. Neill, United States consul at Dublin, in a work entitled English Colonization of America, published in 1871, has deprived her story of a good deal of its romance. According to him, Pocahontas is first heard of as 'tumbling wheels' in the market-place of an English fort, and next as living with a volunteer captain called Cookham. She afterwards separated from him, and was betrayed by her uncle Patoroomek to Captain Argall, the deputy-governor of Virginia. She subsequently did marry a Mr. Rolfe, and was brought to England, where she excited a good deal of curiosity, and died while preparing to return to America.

POCHARD (*Fuligula*), a tribe or sub-family of Anatidæ or Ducks, distinguished by possessing a bill equalling the head in length, and of broad, flat conformation. The bill is depressed at the tip, the apex of the upper mandible terminating in a hooked or curved process. The lamellæ or plate-like processes which fringe the sides of the bill are not prominent or projecting, and are of thin structure. The legs are short, the hinder toe being small, raised on the back of the foot, and provided with a short broad lobe. The tail is generally short and rounded, as also are the wings. The inferior larynx of the male ducks is of strong bony construction. These ducks inhabit the Arctic regions, but migrate southwards in winter to the coasts of Europe and North America; and they even occur in Asia and in the southern hemisphere also. They are marine in habits, and feed upon Crustaceans, worms, molluscs, and aquatic plants. The plumage is thick and dense, that of the male Pochards being frequently lustrous, and usually more brilliant than the plumage of the female.

The Common Pochard (*Fuligula* — synonyms, *Aythya* or *Nyroca—farina*) is also known as the Dun Bird or Red-headed Duck. This form breeds in the northern regions, and visits Britain in winter, flying southwards in America at the latter season to Carolina, Louisiana, &c. It has also been found in India. In size it is somewhat larger than the common ducks, but smaller than the Mallard. The head and neck are coloured bright chestnut. The eyes are red. The flesh is much valued as a savoury article of diet. The *Fuligula glacialis*, or Long-tailed Duck, is another species related to the more typical Pochards. The male of this latter species possesses the two middle feathers of the tail greatly elongated and of narrow form. The Scaup Pochard (*F. marila*) possesses the head and neck of a black colour, beautifully glossed with green hues. The Tufted Pochard (*F. cristata*) possesses a crest of feathers borne on the head. This form is coloured black, and possesses white bars on the wings. The breast and belly are white, as also are the sides. The Canvas-backed Duck of North America (*F. Valisneria*) derives its specific name from its habit of feeding on the *Valisneria spiralis*, an aquatic plant. This species is of larger size than the Common Pochard. The bill is more elevated at the base, and is narrower at its apex. The Canvas-backed Duck arrives in the United States from the northern regions during the month of October, and in November or December they collect in large flocks, and are shot for the sake of their flesh, which is highly esteemed. This form possesses the forehead and cheeks of a dull brown, the back and belly being white, marked with numerous fine black lines.

POCO (Italian for 'a little'), a term used in music in such phrases as *poco forte* (*p. f.*), rather loud; *poco animato*, with some animation; and so forth.

POCOCK, Edward, an oriental critic, was born November 8, 1604, and educated at Oxford, his native place. In 1628 he was ordained priest, and in 1629 appointed chaplain to the English factory at Aleppo, and applied himself there to the cultivation of oriental literature. He was employed by Laud to collect manuscripts and coins for the University of Oxford; and in 1636 was invited to fill the newly founded Arabic professorship at Oxford. He subsequently undertook a second voyage to the East, and remained some time at Constantinople collecting ancient manuscripts. He returned in 1640. In 1648 he was appointed Hebrew professor at Oxford, to which the king, then a prisoner in the Isle of Wight, added the rich canonry of Christ Church; and the grant was confirmed by the Parliament. In 1648–50 he published Specimen Historiæ Arabum (4to, reprinted at Oxford in 1806). In 1650 he was deprived of his canonry for refusing to subscribe the engagement required by the Parliament. In 1654 he published some of the writings of Maimonides, under the title of Porta Mosis, and assisted in Walton's Polyglot Bible. In 1658 appeared his edition of the Annals of Eutychius, in Arabic, with a Latin version (two vols. 4to). The Restoration in 1660 enabled him to recover his church preferment; and the same year he printed an Arabic translation of Grotius' work on the Truth of Christianity. In 1661 he published Lamiato 'l Ajam, an Arabic poem, with a Latin translation and notes. He died at Oxford in 1691. An edition of his works was published at London, in two vols. folio, in 1740.

POD, in botany, a long-shaped fruit containing several seeds. When the fruit on coming to maturity opens longitudinally on both sides, disclosing the seeds arranged in a single row on one of the sutures (the ventral, or that next the axis of the plant), it is called a *legume*, as in the pea or bean. Sometimes the pod is twisted like a snail, as in the Medicago, sometimes vermiform, as in the Divi-divi. When the pod is divided into sections by the contraction of the fruit above and below each seed, and these segments fall away separately when the fruit is ripe, it is called a *lomentum*. When it opens by two longitudinal valves, disclosing two rows of seeds on opposite sides of a central frame called a *replum*, it is called a *siliqua*, a form of fruit exemplified in some of the Cruciferæ. A short siliqua is called a *silicula*.

PODAGRA (Greek, literally 'a trap for the feet'), that species of gout which recurs at regular intervals, attacking the joints of the foot, particularly of the great toe, and attended with sharp pain. The pain is described as resembling that produced by laying a burning coal upon the toe, or by forcing asunder the joint with a red hot iron. When the disease is violent the whole foot is so sensitive that the slightest pressure, the lightest touch, or even the agitation occasioned by a strong draught of air, causes the most excruciating pain. The first stage of the disease is peculiarly painful, on account of the inflammation of the surfaces of the joints, by which the nerves are affected. In a week, or sometimes a fortnight, the inflammation subsides, the pain ceases, and the part becomes swollen. The swelling contains the product of the gouty inflammation, lymphatic mixed with earthy substance. It gradually subsides, leaving here and there swellings on the foot. The attacks usually recur once a year, in spring or autumn, sometimes twice, and even oftener. As long as they are regular they are not dangerous, as nature has the power of throwing off the disease in the extremities. The notion that there is no remedy against the podagra, and that a person who has been once attacked can never be cured, is erroneous. By shortening the period of inflammation the secretion of the gouty matter may be promoted, and the pain more speedily assuaged. In the interval of the attacks, if attention is paid to the diet and manner of living, if the patient confines himself to simple food, and avoids the exciting causes of the disease, its violence may be gradually diminished, and the disease itself may be eradicated; while, by the neglect of these precautions, it continually becomes aggravated, and, as the system grows weaker, irregular and retrocedent, in which stage it is often fatal. See Gout.

PODALIRIUS. See Æsculapius.

PODESTÀ, an Italian word, derived from the Latin *potestas*, power, equivalent in its original meaning to a holder of power or authority. In several of the Italian cities it is applied sometimes to the chief of police, and sometimes to the chief magistrate or burgomaster. The office was first established in the

twelfth century by Frederick I. in the principal towns of Italy, and was in the middle ages a much more important one than it is now. The podestà was intrusted almost with dictatorial power, the only limitation being that there was an appeal from his decisions. Some of the dangers likely to arise from a single individual having so much power in his hands were guarded against by confining his authority to a short period, a year or half a year; yet it was not always easy to enforce this regulation against the podestà, and when the municipal government began to totter in most of the towns of Italy, this office often served as a preparation for the establishment of princely government. Venice and Genoa used to govern the towns which they had brought into subjection by means of officers bearing this title.

PODIEBRAD AND KUNSTAT, GEORGE BOCZKO VON, the son of Heraut von Kunstat and Podiebrad, one of the greatest and wealthiest of the Bohemian lords of the Hussite party, was born in 1420. When a mere youth he entered with all his soul into the Hussite movement, but during the reign of Sigismund remained attached to the moderate party. When, however, the Catholics had succeeded in securing the election of Albert V. of Austria as Sigismund's successor on the German throne (1438), Podiebrad allied himself to the utraquistic states in Tabor, and invited Casimir of Poland to become King of Bohemia. They were, in consequence, involved in a war with Albert, and so closely pressed that they were obliged to shut themselves up in the castle of Tabor. Here their ruin seemed inevitable, but Podiebrad, by a bold movement, effected their relief, and obliged Albert to retire upon Prague. Albert, however, still retained the title of king. Podiebrad was now held in the highest esteem by the utraquists, and was, after Lipa, the first man of their party. After the death of Albert in 1439 Lipa was chosen regent of Bohemia, and this office he continued to hold after the birth of Ladislas, Albert's posthumous son, early in the following year. Under Lipa's regency Podiebrad held the chief command in utraquist Königgrätz, and after Lipa's death became his successor (1444). Opposition, however, arose, and it was not till 1451 that he was universally recognized as regent. In 1453 the young King Ladislas came to reside at Prague; but Podiebrad still continued to hold the reins of government, and ruled with more authority than ever. He gave a vigorous impulse to commerce and agriculture, and made and enforced many wise regulations for the well-being of the people. He thus gained so much popularity and esteem that on the death of Ladislas in 1457 he was continued in the office of regent, and in March, 1458, was elected king by a unanimous vote of the assembled states. He now displayed the full force of his talents. In a short time he was acknowledged in Moravia, Silesia, and Lusatia, as well as by the Emperor Frederick and the German electors. After he had secured his throne he devoted his whole attention to the internal improvement of the state. He placed the currency on a proper footing; erected schools and churches, and endeavoured, by friendly conference, to terminate religious animosities. To meet the complaints of the Roman Catholics he banished the Taborites, Picardites, and other sects from the country, and tried to make arrangements with the pope. In this, however, he was unsuccessful; and in 1463 the pope publicly denounced him as a heretic, and then, though urged by all neighbouring princes to moderation and peace, excommunicated him. The Papal legate, Rudolf, skilled in intrigue, soon produced a rising among the Catholics, and in 1466 a German crusade was formed against Bohemia. The invaders having been defeated at Riesenberg, the pope reiterated his excommunication. After making an appeal to a general council of the church, Podiebrad recalled the Taborites, whom he had driven into exile, defeated an army of Silesian crusaders at Munsterberg and at Frankenstein, and a German army at Neuern; and in 1468 despatched an army under the command of his son Victorin to invade Austria, the Emperor Frederick having also betrayed him. Matthias Corvinus, who, although he was the son-in-law of Podiebrad, and indebted to him for his release from captivity when called to the throne of Hungary, had long cherished designs on Bohemia, took advantage of this circumstance to make war upon his benefactor. At the invitation of the emperor he drove Victorin out of Austria, and penetrated into Moravia, where he came to an understanding with the chiefs of the league that had been formed against Podiebrad, and marched against that prince. But the generalship of Podiebrad was again successful. In 1469 he hemmed in the Hungarian army at Willemow. Matthias Corvinus sued for a truce, which was generously granted by Podiebrad, who allowed his enemy to withdraw from his critical situation unmolested. In spite of this generous treatment Corvinus, a few months later, had himself crowned at Olmütz, by the chiefs of the league, King of Bohemia. Podiebrad now had recourse to more energetic measures. In order to secure the aid of the Poles he assembled a diet at Prague, and declared the successor to the throne of Poland to be his own successor, while his sons should only inherit the family estates (1469). The diet, with reluctance, adopted the proposal. The Poles were thus immediately drawn to his side; the Emperor Frederick also declared in his favour: and his Catholic subjects also became reconciled to him. Shortly after he destroyed the infantry of the Hungarians, and Matthias Corvinus hastily fled with his cavalry. He thus saw himself at last completely secured in his kingdom; but no sooner was this accomplished than he died (1471), before he had time to carry out his great schemes for the benefit of his country, and others having a much wider scope. His sons, Victorin and Henry, returned to the rank of Bohemian nobles, and in the stormy days which succeeded did not render much service to their country.

PODIUM, in architecture, a long pedestal supporting a series of columns. It is called a *stylobate* when the columns stand on projecting parts of it.

PODOLSK, or PODOLIA, a government in Russia, bounded north by Volhynia, north-east by Kiev, east and south by Kherson, south-west by Bessarabia, and west by Austrian Galicia; greatest length, north-west to south-east, 230 miles; greatest breadth, 110 miles; area, 16,241 square miles. The surface is on the whole level. The climate is temperate, bringing both the vine and the mulberry to maturity; and the air is generally salubrious, though in some quarters endemical diseases occasionally prevail. The soil is very much encumbered with stones, but is notwithstanding of remarkable fertility, producing corn, which, after satisfying the consumption, leaves about one-third of the whole for export. The principal crops after corn are hemp, flax, tobacco, and hops. The meadows and pastures are extensive, and of great luxuriance, rearing immense herds of cattle, which are of an excellent breed, and much prized in Germany, to which they are extensively exported. Large quantities of fine melons, gourds, and cherries are raised, and the forests furnish excellent ship-timber. Manufactures have made little progress. The trade, in addition to agricultural produce and cattle, embraces a considerable number of small articles, and is almost entirely in the hands of the Jews. Education is under the superintendence of the University of Kiev, and is in a miserably neglected

state. Podolsk is divided into twelve districts, and together with Volhynia is under the military governor of Kiev. The chief town is Kamenetz. The government of Podolia has belonged to Russia since the second partition of Poland in 1793. Pop. (1882), 2,204,091.

PODOPHTHALMATA ('stalk-eyed'), a division of the great Crustacean class (see CRUSTACEA), the members or groups of which are primarily distinguished by the possession of compound eyes supported upon movable stalks, often of great comparative length, and termed *peduncles*. Hence the eyes are sometimes spoken of as 'pedunculated,' and the Podophthalmata are sometimes known as the 'Stalk-eyed Crustacea,' in contradistinction to those with the eyes destitute of stalks, and which are accordingly termed 'sessile-eyed.' In the Podophthalmata, also, the united head and chest, or cephalothorax, is always inclosed within a protecting case or *carapace*. The generality of these forms undergo a metamorphosis, the earliest stage, as in the familiar Crabs, being known as a *zoëa*. This division includes the orders Stomapoda and Decapoda, the former of which is represented by the 'Locust,' 'Glass,' and 'Opossum' Shrimps, whilst the latter includes the familiar Crabs, Lobsters, Common Shrimps, Hermit Crabs, and their allies. See also CRUSTACEA, CRAB, LOBSTER, SHRIMP, &c.

POE, EDGAR ALLAN, a celebrated poet and romantic writer, was the son of David Poe, a law student at Baltimore, United States, who made a runaway marriage with an actress. The place and date of his birth are differently given. Griswold, his first biographer, states that he was born at Baltimore in January, 1811. The poet himself placed his birth in the year 1813, but in this he appears to have been wrong. His latest editor, Mr. Ingram, believes him to have been born at Boston on the 19th of January, 1809. Both his parents died within a short time of each other, leaving three children in a state of complete destitution. Edgar, the eldest, attracted by his beauty and precocious intelligence the attention of Mr. Allan, a wealthy merchant, by whom he was adopted and brought up. It was from him that he took his middle name. He was taken by his benefactor and his wife to England, and placed in a school at Stoke-Newington, near London. In 1822 he returned to America, and after attending for some time a school at Richmond, in Virginia, entered, when he was about sixteen or eighteen years old, the University of Charlottesville in that state. Here he displayed the most astonishing talents, but led so dissipated a life that he was ultimately expelled by the authorities. On Mr. Allan refusing to honour some of his drafts for gambling debts he quitted America for Europe, to take part in the struggles of Greece for independence. What happened to him in the year after he left America is not known, but in 1828 he reappears in St. Petersburg, where, it is said, the United States' minister had to interpose in his behalf to save him from the consequences resulting from a drunken uproar in which he had got engaged. He was permitted to return to America, and on arriving there obtained an appointment as cadet in the military academy at West Point, but was shortly after expelled from thence for drunkenness and insubordination. He returned to the house of Mr. Allan, who was still disposed to befriend him, but a quarrel ensued between him and his benefactor, who now fairly threw him off, and ceased to hold any intercourse with him from that time. Some time after he enlisted as a private soldier, but deserted while some friends were on terms for procuring his discharge. Having gained the prize offered by the proprietor of the Baltimore Saturday Visitor for a tale and poem, he was introduced to the notice of Mr. White, who in May, 1835, founded a magazine called the Southern Literary Messenger at Richmond, and appointed Poe the editor. To this magazine he contributed some of his most extraordinary tales, revealing a wild and terrible imagination. He continued to edit this magazine till January, 1837, when he was dismissed, owing to his dissipated habits. During his stay at Richmond he married his cousin, Virginia Clemm, a beautiful and amiable girl. After being dismissed from the editorship of the Southern Literary Messenger he left Richmond, and removed in the course of the same year successively to Baltimore, Philadelphia, and New York, in which last place he became a contributor to the New York Review, and in 1838 published a story entitled The Narrative of Arthur Gordon Pym. In the same year he returned to Philadelphia, where from May, 1839, to June, 1840, he edited Burton's Gentleman's Magazine, and in the latter year published a collection of all the stories he had written, under the title of Tales of the Grotesque and the Arabesque. From November, 1840, to about April, 1842, he was editor of Graham's Magazine, and wrote for it some of his choicest productions. In 1844 he removed to New York, and in the year following published his wonderful poem of The Raven, which took the world by storm by its weird-like and mysterious beauty. Numerous other pieces were contributed by him to various magazines and periodicals; but all the advantages of genius were insufficient to cope with the degrading influences of evil habits, and his necessities became so great that an appeal to the public for pecuniary aid was made on his behalf by one of his friends. In 1847 his wife died; he himself fell ill, and was tended with the utmost solicitude by his mother-in-law. In 1848 he delivered a series of lectures on the constitution of the universe, afterwards published under the title of Eureka, a Prose Poem. In 1849 he went to lecture in Virginia, and on his return to New York passed through Baltimore, where he fell in with some acquaintances, who invited him to drink. He lost all command of himself; was found in a state of helpless intoxication in the street; was conveyed to the hospital, and died there on the 7th October, 1849. A more melancholy career than that of Poe can scarcely be imagined. It is now known that the memoir of Poe by Rufus Griswold is the work of a malignant enemy, and wholly untrustworthy; and Mr. Ingram, already mentioned, in a sketch of his life prefixed to an edition of his works, has defended him against the grosser charges which have been brought against him, and has shown that in ordinary life he was fairly gentle and tractable; but it is undeniably the case that he was too often the victim of intoxicating liquors, to the effect of which he was singularly susceptible. 'With a *single glass* of wine,' according to the account of one who knew him, 'his whole nature was reversed; the demon became uppermost, and though none of the usual signs of intoxication were visible, his *will* was palpably insane.' Among his poetical pieces we have already alluded to The Raven, and may mention, in addition, the singularly charming and euphonious lyric of The Bells, and the poems of Ulalume and Annabel Lee. The most complete edition of Poe's works is that already alluded to, by John H. Ingram (four vols. Edinburgh, 1874).

POE-BIRD. See HONEY-EATER.

PŒCILE (Greek, *poikilē*, literally 'variegated'), a portico in Athens, containing a picture-gallery. (See POLYGNOTUS.) The philosopher Zeno taught his doctrines here, whence he was called the *Stoic* (from *stoa*, a portico), and his school the *Stoic school*. See ZENO and STOICS.

POELEMBURG, Cornelius, a painter, born at Utrecht in 1586, became a pupil of Bloemaert, and afterwards went to Rome, where he studied Raphael's works. In 1621 he returned to Holland. Being deficient in design, he confined himself principally to small landscapes, in which he excelled. Rubens adorned his own cabinet with Poelemburg's productions. Charles I. invited him to England, where he painted a portrait of the king and other works, but soon returned home, and died at Utrecht in 1660. His works are rare, and esteemed for delicacy of touch and sweetness of colouring.

POERIO, Carlo, an Italian statesman, born at Naples December 10, 1803; died at Florence April 28, 1867. He was the son of Giuseppe Poerio, who on more than one occasion signalized himself by his determined opposition to the constitutional encroachments of the Bourbon kings of Naples, and thus drew upon himself sentences of exile. Carlo shared the sentiments of his father, and accompanied him in his banishment. On his return to Naples he devoted himself to the law, and rapidly rose into prominence by his readiness to advocate the cause of political offenders. In this way he incurred the displeasure of the government, and was several times arrested and imprisoned for shorter or longer periods. At the time of the revolutionary movements of 1848 he happened to be undergoing one of his periods of confinement, but suddenly saw himself pass from the condition of a prisoner and suspected person to the position of a popular patriot. He was made prefect of the Neapolitan police and minister of public instruction, and cherished the hope of being able to inaugurate a reign of liberty for the Kingdom of the Two Sicilies with the aid of the Bourbons, who were then lavish of their promises. The events of the 15th of May, 1848, when the king bombarded the town of Naples from the forts, disabused him of this illusion, and he then resigned his office and retired into private life. Elected a member of the new parliament, which met soon after, he joined the ranks of the opposition, with which he continued to act till the dissolution on the 12th of March, 1849. Being warned of the intention of government to prosecute him on the charge of complicity in an alleged conspiracy, he refused to seek safety in flight, and after many attempts to convict him of some political offence by a procedure having some appearance of regularity, he was in June, 1850, condemned to suffer an imprisonment of twenty-four years, by a court which refused to hear anything in his defence. In prison he was subjected to the most barbarous tortures and indignities, being compelled to associate with the lowest class of criminals. An account of the persecutions which he and other political prisoners had to endure will be found in Gladstone's famous Two Letters to Lord Aberdeen, written from Naples, copies of which were sent by the British government to the court of every European state. In 1859 his sentence was commuted by Ferdinand to transportation, and he was removed to Cadiz and put on board an American vessel with the object of being conveyed to South America; but having convinced the captain of the vessel of the illegality of this proceeding, he induced him to land him in Ireland, along with his companions in misfortune. On leaving the United Kingdom he repaired to Piedmont, where he was received as a martyr. In November, 1860, after the annexation of Naples to the new Kingdom of Italy, he joined the Fanti ministry as minister without portfolio, and his popularity, due to his political character as much as to the sufferings which he had passed through, gave him great influence in the new government. In March, 1861, Poerio, as representative of Naples, was elected vice-president of the Italian chamber of deputies, and he remained till his death one of the chiefs of the constitutional liberal party. He was buried at the public expense at Naples, his native city. In the year of his death an *éloge* on him was published at Naples, having the title Della vita e de' Tempj di Carlo Poerio: Discorso recitato dal Socio S. Baldacchini.

POET LAUREATE. See Laureate.

POETRY (from *poet*, the Greek *poiētēs*, a maker or creator, from *poieō*, I make, with reference to the creative power essential to a poet). The numberless unsuccessful attempts to define poetry warn us against circumscribing within the compass of a few words a subject so vast, so variegated, and so interwoven with all the activities of the human spirit. The definitions usually given, even if true, amount only to illustrations or explanations. To make a full exposition of our views on this subject would far exceed our limits. One of the chief traits of the poetical is that it peculiarly affects the imagination and the feelings. When we speak of actions or the creations of genius as poetical, the term implies further that they had their origin in conceptions in which the imagination and the feelings were chief agents. Hence the universality of poetry; hence the preponderance of the poetical in the language and conceptions of early nations. A common idea, the result of experience or simple reasoning, may be conceived (and accordingly expressed) by the poet in such a way as to strike our feelings with peculiar force; or ideas which, though elevated in themselves, are familiar to all, may receive new impressiveness from a new and striking way of expressing them. For instance, the precept to love our enemies; who does not feel that this elevated sentence is rendered still more striking by the illustration of Manu, who adds to the precept, 'like the sandal-tree, which sheds perfume on the axe that fells it?' A great part of poetry, in fact, consists in a striking expression of common ideas. It is gratifying to find a new conception of a familiar idea presenting the subject in a light in which we had never viewed it. But if the language addressed to feeling and imagination chiefly is often used to convey a plain idea poetically, or to give a familiar one a new charm, this language, on the other hand, is often the natural expression of an elevated imagination, which soars through regions to which our wishes, hopes, and faith aspire, and speaks in metaphors because common language is inadequate to express its conceptions. According to its subjects, and the relation which the poet holds to his productions, poetry is divided into the poetry of subjective feeling, or lyrical poetry; narrative poetry, including the ballad and the epic, that branch which presents actions as happening, while the poet himself is kept entirely out of view; dramatic poetry; didactic poetry, in which the ostensible object of the poet is to inculcate moral precepts, or to teach some art or science, although in reality it is to present that art or science to view under its beautiful and generally attractive aspects; and satirical poetry. (See the separate articles on these subjects.)

Poetics is the theory of poetry. It is one of the theories earliest developed—nay, æsthetics grew out of it. Among the Greeks Aristotle treated it in his Peri poiētikēs (best edition by Gottfr. Hermann). Horace, in his Ars Poetica, or Letter to the Pisos, shows himself his pupil. In modern times it has been treated by Marc. Hier. Vida, Torquato Tasso, and many other Italians; Nic. Boileau, Jul. Cæs. Scaliger, Ger. Voss, L. Racine, D'Alembert, Marmontel, Baumgarten (the founder of æsthetics), Salzer, Engel, Jean Paul Fr. Richter (in his Vorschule der Æsthetik), Clodius, Lessing, Klopstock, W. von Humboldt, Herder, Schiller, Goethe, the

Schlegels, Müller, Hegel, and others; in English by Blair, Wordsworth, Campbell, Hazlitt, and others.

We may divide the history of poetry into two periods—the one before the birth of Christ, the other since. The Hebrews are the first people from whom poetical productions have descended to our times. Only obscure traces remain of any earlier poetry of the Indians, Persians, Syrians, and Arabians. The religious poetry of the Hebrews is of very ancient date, and possesses a solemn character, distinct from that of the other nations of antiquity. It begins with cosmogony, becomes at a later period of a warlike character, then assumes the form of sacred songs in the time of David, and attains under Solomon (from 1044 to 975) its greatest elevation, after which it assumes a prophetical character. The fragments which have come down to us from the flourishing period of Indian poetry, some centuries before Christ, are of an original character and peculiar delicacy. We next come to classic antiquity, and become acquainted with poetry in the plastic character which it assumed in Asia Minor and Greece, under the influence of the prevailing paganism, which received such rich and various hues from the glowing imagination of the people. Greek poetry may again be divided into three periods: the first of these extends from the earliest times of Greece to the Persian war. Greek poetry begins in Thrace and Asia Minor, and the great national epics of Homer, or the Homeridæ, the rhapsodists, the cyclic and gnomic poets, indicate a wide diffusion of poetry at that time. Lyric poetry soon attained a peculiar eminence. The second period extends from the Persian war to the time of Alexander the Great. It is the flourishing period of the dramatic art, and of cultivated Greek poetry in general. The third period shows the decline of Greek poetry under the successors of Alexander, and the revival of the same in Alexandria. (See GREECE—Literature.) From the Greeks we turn to their imitators, the Romans, whose language was not employed in poetry till a late period, and who, until the second Punic war, or until the time in which they became closely connected with the Greeks, made only rude essays in poetry. The era of Augustus and Tiberius was the golden age of their poetry, and it thence declined continually until the introduction of the Christian religion, and the irruption of the barbarians. After the Christian religion became prevalent, we find the Latin language applied in the Christian worship to a mystic religious poetry; and later, in the ninth, tenth, and succeeding centuries, employed by learned men in imitations of the old Roman poetry. Contemporary with these we witness the rise of Arabian poetry. (See ARABIAN LITERATURE.) A peculiar poetry sprung up among the French, in the time of the Provençals or Troubadours of the south, and the Trouvères of the north in the eleventh century. In its devotion, valour, and love the spirit of chivalry is apparent. (See ROMANTIC.) This romantic poetry of the Franks declined into mere artificial rhyming after the end of the twelfth century. Under the dominion of Francis I. poetry somewhat revived; but the age of Louis XIV. was the golden era of French poetry, although it often, but in its own manner, imitated the ancients, and modernized ancient materials. Rhetorical elegance and easy wit were its chief aim. (See FRANCE—Literature.) The modern Italian poetry sprung from the Provençal. But a poetry of a natural character began in Sicily after the thirteenth century, and flourished, peculiarly from the time of Dante and Petrarch to that of Ariosto and Tasso, in the thirteenth, fourteenth, and fifteenth centuries, and thence declined into bombast and imitation. (See ITALY—Poetry.) The Spanish poetry appears originally the sister of the Provençal, but mingled with the oriental character. The earliest Castilian poetry, properly so called, belongs to the thirteenth century; but it began to flourish under the administration of Charles I., and declined under Philip IV. Simultaneous with it, and in connection with it, flourished the Portuguese. (See SPAIN and PORTUGAL, sections Literature.) The German poetry, which is closely connected with the northern, and has its own epic cycle, flourished at various times, and with much variety of character, but most vigorously when free from the influence of foreign models. (See GERMANY—Literature, MINNESINGERS, and MASTERSINGERS.) The origin of the English and Scottish poetry is lost, like that of the German, in the distant period of the bards; it was refined by the Norman French poetry. But the flourishing period of English poetry is placed in the times of Queen Elizabeth, although Chaucer is esteemed the father of modern English poetry. The Scandinavian poetry, otherwise called northern, presents chivalry peculiarly coloured by the northern character, since the thirteenth century, when the German Heldenbuch (book of heroes) was introduced into Norway, and foreign tales became blended with native ones. For further information the reader is referred to the sections on literature in the articles on different countries, and also to Warton's History of English Poetry, Sismondi's Littérature du Midi de l'Europe, Bouterwek's Geschichte der neuern Poesie und Beredsamkeit, Rosenkranz's Handbuch einer allgemeinern Geschichte der Poesie, and Zimmermann's Geschichte der Poesie aller Völker.

POGGIO BRACCIOLINI, one of the early promoters of classical literature in Italy, was born at Terranuova, between Florence and Arezzo, in 1380 or 1381. On completing his education he went to Rome, where he obtained the office of writer of apostolical letters under Boniface IX., and kept it under the seven following pontiffs. In this capacity he attended John XXII. in 1414 to the Council of Constance. In 1416 he undertook the task of searching the monasteries for ancient manuscripts; in that of St. Gall he discovered a complete copy of Quintilian, with a part of the Argonautics of Valerius Flaccus, and in other religious houses several of Cicero's orations, and obtained copies of the works of Silius Italicus, Vegetius, Ammianus Marcellinus, Columella, &c. In 1418 on the invitation of Cardinal Beaufort he visited England; but the barbarism of the country at that period soon led him to return to Rome, where he resumed his former office of apostolical secretary. During the disturbances which took place under the pontificate of Eugenius IV. he quitted Rome, and went to reside at Florence. In 1447 he returned to Rome again to enter once more on his old functions under Nicolas V., which he finally resigned in 1453 in order to undertake the office of chancellor of the Republic of Florence. He died in 1459. Poggio was licentious, quarrelsome, and intemperate in controversy; but his sentiments are in general liberal and manly, and he may be deemed the most elegant composer in Latin (the language of nearly all his works) of that period. His writings are numerous, and upon various topics. Many are discussions on moral arguments, a few are philosophical, and several controversial; the remainder are chiefly translations, orations, and letters, the chief fault of which is diffuseness. His Historia Florentina, which comprises the period from 1350 to 1455, is to be found in the collections of Grævius and Muratori. An Italian translation of it by his son was published at Venice in 1476. His Liber de Nobilitate is said to be one of the most finished of his works; but his Letters are at the present day the most interesting of all his remains. They make us

acquainted with a multitude of curious facts, of which we should otherwise have been ignorant, and contain a vivid and animated picture of that epoch of the Renaissance, in which, printing not yet having been invented, or not having come into general use, Italian scholars applied themselves to putting in safety all the remains of antiquity that had escaped complete destruction. The whole of the works of Poggio were published together at Basel, 1538. See his life by Shepherd (Liverpool, 1802).

POICTIERS. See POITIERS.

POINDING, in Scotch law, a legal proceeding by which the property of a debtor's movables is transferred to the creditor. It is of two kinds, *real* and *personal*. In the former case it is the ground that is poinded, and the creditor may take possession of all the goods on the land which the poinding affects, whether these goods belong to the proprietor or tenant of the land. A tenant's goods cannot, however, be poinded for his landlord's debt to a greater extent than the amount of the term's rent or the arrears due to the latter. No other goods than those of the owner or the tenant are affected by the poinding of the ground. Before a creditor can poind the lands of his debtor he must raise an action, with the object of obtaining what is called a *diligence* for doing so. In an action of this nature both tenants and owners must be made parties, although the conclusion is not a personal one, but refers only to the goods on the ground, which accordingly may be taken possession of without first charging the tenant to make payment, and at any time, even after the original defender is dead or removed. The action is competent to a superior for his feu-duties, to an annual-renter for the arrears of his interest, and in general to all creditors in debts which form a real burden or lien on the land; but is not competent to proprietors, or even to creditors or others in possession of the ground. In personal poinding, which is competent to all classes of creditors in ordinary personal obligations, it is the movable goods and effects of the debtor that are poinded. After a decree allowing the resort to this proceeding has been obtained, the creditor, unless he be a landlord poinding for bygone rents, or a superior for feu-duties, must first charge the debtor to make payment, and wait till the days of the charge have elapsed, before putting the decree in operation. *Plough-goods*, that is to say, horses, oxen, and other goods used in connection with ploughing operations, cannot be poinded during the period of tillage. When the poinding takes place, the goods affected by the proceeding are appraised by two valuators appointed by the creditor, and a schedule of the goods with their appraised values is given to the debtor, who retains possession of the goods, until the date fixed by a warrant of the sheriff or other judge-ordinary for the sale of the goods by public roup. The amount yielded by the sale after the deduction of expenses is handed over to the creditor to the extent of his debt, and if no purchaser appear the goods themselves are handed over to him at their appraised values. The term poinding is also applied to the seizing of stray cattle found trespassing on inclosures, and retaining them until compensation is made for the damage done by them. In the case of no agreement being come to between the owner of the cattle and that of the inclosure, as to the amount of the compensation to be paid, this may be fixed by the proper officers, who will allow to the proprietor of the inclosure a certain sum on account of the damage done, besides a penalty of half a merk for each of the cattle found trespassing, and the expenses of keeping the cattle during the time that they have been detained. (Bell's Dictionary of the Law of Scotland.)

POINT, in geometry, as defined by Euclid, is a quantity which has no parts, or which is indivisible. Points are the ends or extremities of lines. If a point is supposed to be moved any way, it will by its motion describe a line.

POINT, an iron or steel instrument, used with some variety in several arts. Engravers, etchers, cutters in wood, &c., use points to trace their designs on the copper, wood, stone, &c.

POINT-A-PITRE, a town in Guadeloupe, in the West Indies, on the south-west coast of the Grande-Terre, at the mouth of the Rivière-Salée, the strait which separates Guadeloupe proper or Grande-Terre from Basse-Terre. It has a spacious and secure harbour, defended by two forts and several batteries. It is one of the most important commercial towns of the Antilles. The principal exports are sugar, spirits of molasses, cocoa, cassia, raw hides, coffee, dye-woods, indigo, preserved fruits, tortoise-shells, rum, &c.; and the principal imports, woven fabrics, articles in leather, cod-fish, grain and flour, olive-oil, articles in metal, cattle, horses, wine, &c. The town was almost completely destroyed by fire in 1780, after which it was rebuilt in stone; but having been again destroyed by an earthquake in 1843, it was rebuilt in wood, and was again burned down in July, 1871. The want of water makes the town peculiarly liable to such calamities. Since the last fire the town has been rapidly rebuilt. Pop. 19,000.

POINT BLANK, originally the white spot in a target, at which an arrow or other missile is aimed. Hence, in gunnery, to fire point-blank, to fire at an object so near that the piece may be levelled in a straight line with it.

POINT-DE-GALLE, or simply GALLE, a fortified seaport town in Ceylon, on a peninsula on its south coast, 21 miles west of Matura, and 66 miles S.S.E. of Colombo. The appearance of Galle from the sea is singularly beautiful and picturesque. To the right is the fort, with its old walls and fortifications jutting far into the sea. In the centre of the town, and rising above every surrounding object, are the two gable ends of the old church built by the Dutch. Further on is the quay, surrounded by multitudes of canoes, and on a height is a neat and beautiful Roman Catholic chapel, while close to the harbour is the native town and bridge, white, and shaded by numerous trees, the whole backed by verdant hills clothed to the summit with woods, and the most luxuriant vegetation. The more distant hills assume a purple hue, and far in the rear rises the lofty summit of Adam's Peak, 7420 feet high. The fort is more than a mile in circumference, commanding the whole of the harbour, but in its turn commanded by a range of hills about 700 yards distant. Outside the town is a Buddhist temple with colossal figures upon it. The trade of Galle chiefly consists in coir rope, cocoa-nut oil, arrack, chaya root, coffee, cotton, rice, ivory, cinnamon, and tortoise-shell. The entrance to the bay is about a mile wide, the soundings in it from 7½ to 4½ fathoms, but rendered somewhat intricate by sunken rocks. The outer road is spacious, and in the inner harbour ships may lie in perfect security in 5 or 5½ fathoms abreast of the town, but only for four months in the year. The mail steamers of the Peninsular and Oriental Company call here regularly. Pop. 47,954.

POINTER DOG, a variety of dogs, so named from their habit of suddenly stopping when in the neighbourhood of game, and 'pointing' with the head in the direction in which the prey or quarry lies. This faculty, peculiar to this breed of dogs, renders them invaluable to the sportsman in marking game. It is undoubtedly hereditary in the Pointers, although it as certainly becomes better developed under training. The Pointer, generally known under

the scientific appellation of *Canis avicularis*, would appear to be nearly related to the true Hounds. The term 'Spanish' Pointer, frequently employed, would seem to denote that Spain or Western Europe was the original habitat of these dogs. The Pointers are smooth short-haired dogs, generally marked black and white, like the fox-hound, but occasionally coloured altogether black. The acute sense of smell which guides these dogs in 'pointing' appears to be exerted notwithstanding the prevalence of other and even more powerful odours than the mere scent of game; and the dog, once having pointed, remains motionless, and restrains himself from the slightest movement calculated to disturb the game. These dogs have been known to stand 'pointing' for more than an hour at a time.

POINT OF SIGHT. See PERSPECTIVE.

POISON. A poison is any substance of which a small quantity taken into the stomach, mixed with the blood by wounds, inhaled through the lungs, or absorbed through the skin, can produce changes in the bodies of brutes or men, deleterious to the health, and even destructive to life, by means not mechanical. Many poisons operate chemically, corroding the organized fibre, destroying the form and connection of the parts, exciting powerfully, and causing inflammation and mortification. To this class belong most of the poisons of the mineral kingdom; as, 1. Many metallic oxides and salts, as arsenic, one of the most destructive poisons, of which a few grains produce fatal effects. Many preparations of copper are also poisonous, as verdegris, or acetate of copper, and many paints; also very acid or salt articles of food or drink cooked in copper vessels. Many preparations of quicksilver, as corrosive sublimate, red precipitate, &c., some common preparations of antimony, should also be named here. 2. Strong mineral and vegetable acids, when introduced into the body in an undiluted state, as concentrated sulphuric acid or oil of vitriol, nitric acid or aqua-fortis, hydrochloric acid, &c. 3. Some plants contain an extremely powerful and corrosive substance, as the wolf's milk (*Euphorbium esula*), the *Daphne mezereum*, &c. 4. Of the animal kingdom, the *cantharides* (which see) or *Spanish flies*, as they are called. The operation of all these poisons is very expeditious; when they enter the stomach violent sickness is felt, incessant straining and vomiting take place, with most excruciating pains in the stomach and bowels, as if knives were driven through them; then follows inflammation, if relief be not speedily obtained, and this is succeeded by mortification. Other poisons operate more by a powerful action upon the nerves, and a rapid destruction of their energy. These are the sedative or stupefying poisons, and belong for the most part to the vegetable kingdom. Their effects are sickness, violent headache, dizziness, darkness or spots before the eyes, powerful and involuntary motions of the limbs and of the whole body; distortion of the eyes, anguish, loss of consciousness, and at last apoplexy and death. To this class belong opium, hemlock, henbane, belladonna, &c. There is also a similar poison formed by the action of the saliva on the bitter almond and the kernel of peaches, which is rapidly destructive of life (prussic acid), which shows its effects either when those substances are taken into the stomach in great quantities, or when their concentrated oil, obtained by distillation, is swallowed. The same substance is found in the cherry laurel. Among plants, there are many which unite the properties of both kinds, which stimulate by means of a sharp, acid substance, and are also subsequently sedative, from the operation of a narcotic principle. To these belong the purple foxglove, the monkshood or aconite, &c. Other poisons operate by suddenly and entirely destroying many of the functions necessary to life. To this class belong all the kinds of gas and air which are irrespirable, suffocating vapours, as carbonic acid gas, or fixed air in cellars, where beer is working, wells, &c., fumes of sulphur and charcoal, air corrupted by the respiration and perspiration of many people in closed rooms, concentrated effluvia of flowers in similar places, &c. Many preparations of lead, as acetate or sugar of lead, carbonate or white-lead, wine sweetened by the addition of lead, are to be counted in this class, since they destroy the activity of the absorbent vessels in the abdominal canal, contract the bowels, produce colicky pains, and finally prevent the absorption of the chyle by which the body is to be nourished. Pope Clement XIV., according to the common belief in Italy, was destroyed by a terrible poison, called *l'acquetta*. The Indians of South America, between the Amazon and the Orinoco, apply a very powerful poison, called the *Wourali* poison, to the heads of the arrows with which they shoot their game. It destroys life very quickly, without corrupting or imparting any bad quality to the flesh. The so-called *morbid poisons*, or *contagions*, do not belong to this class, and are very improperly called *poisons*, as, for instance, the poison of hydrophobia. See CONTAGION.

Every substance is called an *antidote* which counteracts the effect of a poison, more especially the remedies which belong to each kind of poison respectively. Antidotes are as various as poisons. They sometimes protect the body against the operation of the poison, sometimes change this last in such a manner that it loses its injurious properties, and sometimes remove or remedy its violent results. Thus in cases of poisoning by acrid and corrosive substances we use the fatty, mucilaginous substances, as oil, milk, &c., which sheathe and protect the coats of the stomach and bowels against the operation of the poison. Against the metallic poisons, soap and sulphide of potassium are most efficacious, as they prevent the operation of the poison by combining the alkali and sulphur with the corrosive particles of the metal. Oil, alkalies, and soap are the best remedies for the powerful acids. For cantharides, mucilage, oil, and camphor are employed. We oppose to the narcotic poisons the weaker vegetable acids, as vinegar. Prussic acid is neutralized by alkalies and freshly precipitated oxide of iron. To arouse those poisoned by opium, we use wine, coffee, brandy, camphor, &c. It was formerly believed that all poisonous matters could be thrown out of the body with the perspiration; and hence we find among the old antidotes a large number of sweating medicines. In this idea originated the *alexipharmacon* of the ancients, the famous *mithridate*, the *theriaca*, &c., which produced, however, no other effect than increased activity of the nervous and circulatory system, from which followed sweats, and perhaps as much harm as good to the sufferer.

The law as to the sale of poisons in Great Britain is contained in the Pharmacy Act of 1868 (31 and 32 Victoria cap. cxxi.). It is there provided that no one is to sell poisons unless he is a pharmaceutical chemist or chemist and druggist, as defined in that act (see CHEMISTS), and then only in conformity to certain regulations. The substances to be considered as poisons are enumerated in the act, and divided into two classes, the sale of which is differently regulated. Those belonging to the first class are: arsenic and its preparations; prussic acid; cyanides of potassium and all metallic cyanides; strychnine and all poisonous vegetable alkaloids and their salts; aconite and its preparations; emetic tartar; corrosive sublimate; cantharides; savin and its oil; ergot of rye and its preparations. Those of the second class are: oxalic acid; chloroform; belladonna and its prepara-

tions; essential oil of almonds, unless deprived of its prussic acid; opium, and all preparations of opium and of poppies. With regard to the substances included in both classes, it is enacted that when sold either wholesale or retail, they must bear the special name of the article, and the name and address of the seller, and be labelled 'poison.' Exception is made, however, in the case of articles exported from Great Britain by wholesale traders; or supplied wholesale to retail dealers in the ordinary way of business, which do not require to have the name and address of the seller affixed to them. With regard to the articles enumerated in the first class, it is enacted in addition that they shall not be sold to any person unknown to the seller, unless introduced by some person who is known to him, that the sale of any of these articles shall be entered in a book stating, in a form provided by a schedule, the date of sale, the name and address of purchaser, the name and quantity of the article sold, and the purpose for which it is stated by the purchaser to be required, and that this entry shall be signed by the purchaser, and if he has been introduced by any one, also by his introducer. Exporters and wholesale dealers supplying retail dealers are excepted also from these provisions; and with regard to medicines containing in them any of the substances in the first class, and supplied to patients by legally-qualified apothecaries, all that is required is that the medicine shall be properly labelled, and that the ingredients of which it is composed shall be entered in a book along with the name and address of the person to whom it is sold or delivered. Before the passing of the Pharmacy Act of 1868, the only poisonous substance, the sale of which was regulated by statute, was arsenic, with reference to which an act was passed in 1851 (14 and 15 Victoria, cap. xiii.). The Pharmacy Act of 1868 preserves this act intact, but the only provision contained in it, and not contained also in the Pharmacy Act, is one requiring the arsenic to be mixed with soot or indigo in the proportion of 1 oz. of soot or ½ oz. of indigo to a pound, except when the quantity sold exceeds 10 lbs., in which case it may be sold unmixed, provided the purchaser states that it is not to be used for agriculture, and that his purpose could not be served if the arsenic were mixed with the substances mentioned.

POISONING. The use of poisons as means to get rid of an enemy or rival, or even of any person standing in one's way, is always exemplified in the records of crime, but there have been periods in the history of various countries when the practice was peculiarly prevalent. The motives for resorting to this method of taking life are obvious: the facility with which some poisons may be administered without even leading to the suspicion of violence, and the difficulty of proving the fact of poisons having been used even when suspicion has been aroused. This difficulty, however, existed only in times previous to the great advance which has been made in chemical knowledge, and was in a certain way compensated by the inordinate tendency to suspicion that was developed at certain epochs, and which has frequently attributed to poison the deaths of kings and others of the great, who, we have every reason to believe, died in a perfectly natural manner. The practice of poisoning was particularly common at Rome, and other cities of Italy, in the first century of our era. In the reigns of Claudius and Nero a woman named Locusta was notorious as a poisoner, and was said to possess the art of concocting poisons to act with any required degree of slowness or rapidity. About twenty or thirty years later Juvenal describes the practice as still raging in the city, and causing all those who were rich enough for their possessions to be coveted by their heirs to tremble. A further proof of the generality of the use of poison in those days (whether for administering to one's self or to others) is to be found in the rings which have been discovered in the ruins of Pompeii, the majority of which contain large cavities intended, as we know or may reasonably infer from contemporary writers, for the reception of poison. The art which was so common in ancient Italy was perfected in modern Italy in the sixteenth and seventeenth centuries. One of the most subtle poisons invented in that country was the *acqua tofana*, so called from a woman named Toffania, who compounded it, and who was put to death by strangling in 1719, after she had caused the death of upwards of 600 persons. It was still employed at the commencement of the present century, and the secret of its composition is, perhaps, not lost even yet. It was an inodorous and colourless fluid, one drop of which, administered every week, caused the death of a person at the end of two years, if he were attacked by no malady in the meantime, and rendered every kind of malady, however otherwise unimportant, certainly fatal. It was thus remarkably well calculated to avert suspicion, since many of those whose death was really due to it had all the appearance of having been carried off by a natural death. But not only were the most subtle poisons devised, the most ingenious means of applying them were also invented. Thus a peach might be cut in two with a gold knife, poisoned on one side but not on the other. The person who ate the one half died, while the poisoner might eat the other unharmed. A prince of the name of Savelli is said to have possessed a key, on the handle of which was a small point which could scarcely be noticed, but which was rubbed with a certain poison, the action of which on the blood was sure and rapid. Whenever the prince wished to rid himself of any member of his court he would give him this key and bid him bring something from a drawer which it opened, in doing which the person using the key inevitably scratched himself with the projecting point on the handle, and the poison was thus introduced into his system. From Italy the practice and the art of poisoning spread to other countries, but flourished nowhere more than in France. The second half of the reign of Louis XIV. has abundant cases of poisoning to show, in most of which the nobility and sometimes the nobility of the court were mixed up. The young nobles attracted to Versailles by Louis dissipated their fortunes in all sorts of gaieties and debaucheries, and when they had done so their only resources for recovering themselves were gaming and intriguing for lucrative sinecures. When both of these failed other methods were adopted, and hence the introduction of the ancient Roman practice of heirs using poison to make away with those who kept them from their inheritances, from which arose the name of 'succession powder,' which was given to the preparation used for the purpose. At this period there were well-known houses where assignations might be kept and accouchements take place in secret, and the keepers of these houses added to their occupations that of furnishing means for removing husbands that their wives were tired of, rivals in quest of places, rich relatives, &c. Their trade flourished; they themselves occupied fine houses, rode in carriages, and were attended by numerous servants. For a long time the parliament of Paris turned a deaf ear to the demands of the people that these persons should be brought to justice. At last the case of Madame de Brinvilliers made it impossible for action to be delayed any longer. After her trial and execution things went on as before, till other three skilful and wealthy female poisoners, La Voisin, La Vigouroux, La Fillasti, and two

priests, Lesage and Guibourg, were arrested. During their examination it transpired that they had among their clients persons of both sexes of the highest rank, and the judges were afraid to proceed. Louis XIV. himself grew alarmed at finding how high in station some of those implicated in the charges brought against the poisoners were, and therefore took the case out of the hands of the parliament altogether, and intrusted it to a commission, called the Chambre Ardente, composed of members whom he could trust to make no indiscreet revelations. The guilty persons belonging to the court made their escape across the frontiers as quickly as possible. Since that time the practice of poisoning does not appear again to have become a general one among any class in France. There does not seem to be any evidence of the prevalence of the practice at any time in England to any extraordinary extent, although the cases of murder in this, as in all other countries, always contain a certain proportion in which poison was the means used by the murderer.

POISSON, Siméon Denis, one of the greatest of modern French mathematicians, born in 1781 at Pithiviers, in the department of Loiret, entered the École Polytechnique in 1798. After quitting it he became a member of the Bureau des Longitudes, a professor in the Faculty of Sciences at Paris and in the École Polytechnique, and in 1812 was admitted into the Institute. Napoleon, to whom he was a steady adherent, made him a noble, and conferred many favours on him. He also gave in his adhesion to the succeeding governments. In 1820 he was appointed a member of the council of the university, and in 1837 was called to the Chamber of Peers by Louis Philippe. He died in 1840. He was indefatigable in his scientific labours, and yet, with the exception of his Traité de Mécanique, which forms a kind of era in the history of that branch of science, he has only produced a great number of separate papers, almost always of the greatest value, on electricity, magnetism, heat, the calculation of probabilities, the analysis of infinites, and other mathematical and physical subjects. The papers are scattered in the Memoirs of the Academy, the Journal de l'École Polytechnique, the Journal des Mathématiques, the Annales de Chimie et de Physique, and other collections.

POISSY (Latin, *Pissiacum*), a town in France, in the department of Seine-et-Oise, on the left bank of of the Seine, 11 miles south-west of Versailles. It is a very dirty place, but its weekly cattle market, chiefly for the supply of the capital, is said to be the largest in France; and the town itself possesses considerable historical interest from the famous conference or colloquy, held in 1561, which bears its name, and in which the differences between Roman Catholicism and Protestantism were discussed at great length, but as might have been anticipated, with no decisive result. Among the attendants were Charles X. and Cathérine de Médicis; the principal debaters were Theodore Beza and the Papal legate Ippolito d'Este. Pop. 5047.

POITIERS (formerly spelled Poictiers), a town of France, on the Clain, formerly capital of the province of Poitou, at present of the department of the Vienne, 61 miles south-west of Tours. The space occupied is far larger than the actual population requires, much of it being laid out in gardens and even extensive orchards, and hence much of the town has a deserted and lifeless appearance. The only scene of much activity is the market-place, which in general is densely crowded. The principal edifice is the cathedral, founded by Henry II. of England about 1162, and built in a style exhibiting the transition from the Romanesque to the Gothic. The exterior is rather plain, but it has an imposing interior. There are several interesting Roman remains, particularly the imposing ruins of an amphitheatre, larger than that of Nismes, and capable of containing 22,000 spectators. The manufactures, which are not of much importance, consist of coarse woollen cloth, woollen covers, hosiery, lace, leather, playing-cards, and vinegar. The trade is in clover, lucerne, and sainfoin seeds; corn, wine, hemp, flax, wax, honey, leather, sheep, and particularly goose-skins. Poitiers is historically celebrated for two battles fought in its vicinity, that in which Charles Martel defeated the Saracen army under Abderrahman (October 18, 732), and that between the French under their king John II. and the English under Edward the Black Prince (September 19, 1356). The English army did not exeeed 12,000 men; the French was not less than 60,000; but the English were superior in discipline and subordination, and occupied a more favourable position. The French van was at once routed, and their centre was broken almost at the first onset. John was made prisoner after an obstinate resistance, and though treated with great courtesy by the conqueror, was detained prisoner in London for four years, and obliged to purchase his freedom by the cession of several provinces and the payment of 3,000,000 crowns of gold. (See Froissart, liv. i. ch. 158–174, and ch. 212.) Pop. of the town in 1881, 36,210.

POITIERS, Diana of. See Diana of Poitiers.

POITOU, or Poictou, before the revolution one of the provinces of France, in the western part of the kingdom, between Brittany and Anjou on the north, Berry on the east, the Atlantic on the west, and Angoumois and Saintonge on the south. The departments of Vienne, Deux-Sèvres, and Vendée have been formed out of this province. This district was anciently inhabited by a tribe called Pictavi, from whose name that of Poitou is derived. Henry II. of England acquired possession of Poitou by his marriage with Eleanor, heiress of the last Duke of Aquitaine. Philip Augustus conquered it. It was ceded to the English by the Peace of Bretigny (1360), but was recovered by Charles V. See France —History.

POLA (*Pietas Julia*), a town of Istria, belonging to the circle of Trieste, in the Austrian Kingdom of Illyria, remarkable for its remains of antiquity. It is said to have been originally a Greek colony. Within its ancient walls are seen the ruins of an amphitheatre, which is estimated to have been large enough to accommodate 18,000 persons. This structure is equal to anything of the sort that has come down to us. It is built of the hard white limestone of the country, and consists of three stories, each of which contains seventy-two arcades. There are no stairs remaining, but the exterior walls are almost entire. There are also two temples, one of which is in good preservation, very elegant in design and execution. Pola was most flourishing in the reign of Severus, when it is said to have had a population of 30,000, and when it assumed the proud title of Respublica Polensis. A triumphal arch, erected by Salvia Posthuma in honour of her husband Sergius Lepidus, is in a pretty good condition, and under the name of Porta Aurea is used as a gate of the town. The modern town of Pola has a beautiful and safe harbour, almost completely land-locked. The principal modern edifice is the cathedral, which dates from the ninth century. It is from the neighbourhood of Pola that the Venetian mirror-makers obtain their sand. Pop. (1880), 25,173.

POLACCA. See Polonaise.

POLACCA, or Polacre, a vessel used in the Mediterranean. The masts are usually three in

number, and consist of only one spar, so that they have neither tops nor cross-trees. They are usually rigged with square sails.

POLAND (Polish, *Polska*, meaning 'Flat Land;' Latin, *Polonia* and *Sarmatia*), an extensive territory of Central Europe, which existed for many centuries as an independent and powerful state; but having fallen a prey to internal dissensions, was violently seized by Austria, Prussia, and Russia as a common spoil, partitioned among these three powers, and incorporated with their dominions. In its greatest prosperity it had at least 11,000,000 of inhabitants, and an area of 350,000 square miles, and immediately before its first partition an area of about 282,000 square miles, stretching from the frontiers of Hungary and Turkey to the Baltic, and from Germany far east into Russia; lat. 47° to 56° N.; lon. 15° to 32° E. The territory thus bounded formed one vast and remarkably compact kingdom, divided into Great and Little Poland on the west; Masovia and Podlachia in the centre; Volhynia, Podolia, and the Ukraine in the east; and Lithuania in the north-east. The principal subdivision was into thirty-one palatinates and starostys. These territories correspond to the modern governments of Kovno, Vitebsk, Mogilev, Vilna, Grodno, Minsk, Kiev, Podolia, Volhynia, Kalish, Kjeletz, Lomsha, Lublin, Piotrokov, Plock, Radom, Siedletz, Suvalki, and Warsaw in Russia; the provinces of Prussia and Posen, and the Pomeranian government of Köslin in Prussia; and the Kingdom of Galicia in Austria. The last ten of the Russian governments mentioned constitute what was handed over to Russia by the Congress of Vienna in 1815 as the Kingdom of Poland, and what are now known as the governments of the Vistula.

The most characteristic feature of the surface is its uniformity. With exception of the Carpathians, forming its south-western boundary, and a ridge of moderate elevation penetrating into it from Silesia, it scarcely possesses a single summit deserving the name of hill, but is truly, as its name implies, 'flat land,' presenting the appearance of an almost unbroken plain, composed partly of gently-waving slopes, partly of rich alluvial flats, partly of sandy tracts so barren as to deserve the name of deserts, and partly of extensive morasses. The last, contrary to the general rule, occupy the most elevated part of the interior, and consist of a broad belt curving irregularly in a north-eastern direction from the Hungarian frontiers into Lithuania, and though only from 400 to 500 feet above sea-level, forming part of the great European water-shed, the waters on the one side of it flowing north to the Baltic, while those on the other side flow south to the Black Sea. Its principal streams are the Vistula, with its tributaries Wieprz and Narew; the Warta and Prosna (tributaries of the Oder), the Niemen, and the Dwina, all belonging to the basin of the Baltic; and the Dniester, South Bug, and Dnieper, with its tributary Pripet, belonging to the basin of the Black Sea. The physical configuration of the country makes it admirably adapted for the operations of agriculture, and the fertility of its alluvial tracts is so great that it has sometimes been termed the granary of Europe. As yet, however, its productive powers have never been fairly tested; and its exports of grain, though large, are probably not a tithe of what they might be under more favourable circumstances. Next to grain and cattle its most important product is timber, which in several quarters forms large and splendid forests. The minerals include the precious metals in limited quantity, iron in sufficient quantity, but of indifferent quality; and salt, chiefly in Galicia, where its mines have long been worked on a very extensive scale, and are to all appearance inexhaustible. Owing to the inland situation of the greater part of the country, and more especially to the cold winds which blow from Russia on the east, and from the Carpathians on the south, the winter of Poland is almost as severe as that of Sweden. The summer is abundantly warm, but the general humidity of the atmosphere and the miasma of the marshes, conjoined with a common neglect of cleanliness and other sanitary precautions, make disease sometimes, under peculiar forms, very prevalent. Little progress has been made either in manufactures or trade, the former being chiefly confined to articles of primary necessity, particularly coarse woollen and linen cloth, for the weaving of which almost every family is provided with its domestic loom; and the latter, which is mostly in the hands of the Jews, who are more numerous in Poland than in any other part of Europe, being seldom on an extensive scale, though including the retail of an almost endless variety of objects. For more detailed information regarding the soil, climate, and productions of Poland, see the articles on the modern governments and provinces mentioned above, into which it has been divided.

The Poles are a Slavonic race, possessing fine physical forms, and are strong, active, ardent, and daring. Unfortunately, however, these original qualities of the race, though preserved to a great extent by the privileged classes of the nobility and gentry, whose birthright secured them in the possession of personal freedom, have greatly degenerated in the mass of the people, who till recently were degraded to mere serfs, and had sunk to the level of their condition. The prevailing religion of the Poles is Roman Catholic, though it has not been permitted to retain its ascendency without a struggle. The Reformation early took deep root in the country, and made such rapid progress that bigotry took alarm, and repressed it by lighting the fires of persecution. Since the Russians became masters they have laboured incessantly and systematically to introduce their own religious system, and with a success which seems to intimate that the religious convictions of the inhabitants are held by a feeble tenure, and easily yield to the suggestions of interest. With similar zeal and perseverance the Russians are aiming at the extirpation of the Polish tongue by discouraging the cultivation of it, and not only introducing Russian into the public schools, but making the knowledge of it an essential requisite for office. Among the numerous degradations to which foreign domination subjects the Poles, there is none to which they appear more sensible than this attempt to complete their national destruction by the extirpation of their native tongue.

History.—At a very early period—it cannot now be ascertained how early—all the regions to which the name of Poland was subsequently extended were inhabited by Slavonic tribes, the most civilized of whom, in the ninth century of our era, when the light of history begins to be faintly shed on them, were those occupying the fruitful plains on the Vistula, and called by the Russian chroniclers Liaches, and by the Polish Leches. In the course of time either this people as a whole or a division of them came to be called Poles, that is, 'Slavonians of the plain,' and these Poles ultimately obtained preponderance over the neighbouring tribes, and their name became common to a wider circle of peoples than that to which it was first applied. Like all the Slavonic nations the Poles were originally divided into small communities, and it was long before they became united into a political whole and obtained an important place in history. The earliest princes mentioned in the legendary history of Poland are Lech and the princes of the families of Leszek and Popiel.

After the death of the last prince of the latter family the Poles are said to have elected a prince of the name of Piast (about 842), with whose son Ziemowit the legend acquires greater definiteness. The fourth or fifth of the Piast dynasty, Duke Miecyslaw I., in 964 married Dombrowka, daughter of the Duke of Bohemia, and adopting Christianity founded the first Polish bishopric at Posen. In the previous year he had been compelled by the margrave Gero to acknowledge the supremacy of the German emperor Otto I. and to hold his land as a fief. But this relation of dependence was dissolved under his son Boleslaw I., Chrobry, or the Great, who reigned from 992 to 1025, and was the true founder of the Kingdom of Poland. He united under his sway all the Polish tribes, conquered Danzig and Pomerelia (the western part of West Prussia), Silesia, Lausatia, and Moravia, and on the east advanced as far as Kiev. Bohemia also was for a time under his rule, but was soon lost. His dominions are said to have extended from the Saale to the Dnieper and from the Danube to the Baltic. In the year 1000 Boleslaw received the visit of the Emperor Otto III., on which occasion the Polish archbishopric of Gnesen was founded, and in 1024 he received the crown of Poland in fief from the pope. After his death, however, his kingdom became a prey to internal wars of long duration, and by repeated subdivisions at last completely fell to pieces. The conquered countries recovered their independence. Silesia became a separate kingdom under a collateral branch of the Piast dynasty. The numerous Polish princes were, besides, continually involved in wars with their neighbours the Germans, Russians, Lithuanians, and Prussians. At last Konrad, duke of Masovia, one of the Polish duchies which had been formed out of the dominions of Boleslaw, called in the aid of the Teutonic order of knights against the Prussians, and these, between 1230 and 1404, conquered the whole of the Baltic seaboard from the Oder to the Gulf of Finland. The first king under whom Poland again acquired importance was Ladislaw Lokietek. He inherited the throne of Cracow in 1295, but as the Poles were dissatisfied with him they elected in his place Wenceslaw II., king of Bohemia, who ruled over Poland (or at least over part of it) from 1300 to 1305. In the latter year Lokietek recovered the throne by the sword, and afterwards united under his sway both Great Poland on the Warta and Little Poland on the Upper Vistula. His reign lasted till 1333, when he was succeeded by his son, Casimir III., who, on account of his wisdom as a legislator, and his exertions in civilizing the interior, was surnamed the Great. In order to secure a solid basis for the future greatness of his country he determined, if possible, to remain at peace with his neighbours. With this view he concluded in 1343 the Treaty of Kalisz with the Teutonic order, to which he formally ceded the Oder and the Lower Vistula, of which it was already in actual possession. He fortified the towns and freed them from the oppressions of the nobility, and by his other measures gave a great impetus to the national prosperity. With Casimir the male line of the Piasts was destined to become extinct. The nobility, to whom Ladislaw in 1331 had granted the right of assembling in a diet, now began to barter their votes with the candidates for the throne in exchange for personal privileges, which could be granted them only at the expense of the general body of the people. Casimir died in 1370, and was succeeded by his sister's son, Louis of Hungary, with which kingdom Poland was united till the death of Louis in 1382. Louis's daughter, Hedwig, was now elected Queen of Poland, and although Ladislaw, a cousin of Casimir III., obtained permission from the pope to seize the crown, she was successful in making good her title. In 1386 she gave her hand to Jagellon, grand-duke of Lithuania, who embraced Christianity, was baptized under the name of Ladislaw (II.), and united his grand-duchy to the crown of Poland. After the death of Hedwig, in 1399, he was about to return to his own country; but the Poles, convinced of the advantages derived from the union with Lithuania, maintained him upon the throne, and he thus became the founder of a Polish dynasty which lasted till 1572, and which includes the following seven kings:—Ladislaw II. (Jagellon), 1386–1434; Ladislaw III., 1434–44; after an interregnum of two years Casimir IV., 1446–92; John I. (Albert), 1492–1501; Alexander, 1501–6; Sigismund I., 1506–46; and Sigismund II., 1546–72. Under this dynasty Poland gained in power and extent. The Lithuanians and Poles combined were more powerful against their common enemy the Teutonic knights, who were compelled in 1466 to agree to the Treaty of Thorn, by which they ceded to Poland West Prussia and Ermeland, and recognized the suzerainty of Poland over East Prussia, which in 1525, with the sanction of Poland, was erected by the grand-master, Albert of Brandenburg, into a hereditary duchy. In 1526 the family of Piasts reigning in Masovia became extinct, and the duchy was united to Poland. In 1561, under Sigismund II., the Knights of the Sword, an order in Livonia similar to the Teutonic order, having appealed to the Poles for help against the Turks, agreed to a treaty with the Poles by which the order was secularized and Livonia annexed to Poland, while the master of the order received Courland as a Polish fief by way of compensation. The power of Poland was still further increased in the same reign in 1569, when the union of Poland and Lithuania was consummated by the admission of the Lithuanian nobles into the Polish diet. On this occasion Warsaw, a town situated in the duchy of Masovia, and thus neither Polish nor Lithuanian, was fixed upon as the place where the common diet should meet. The principal internal change which took place in Poland was the organization of representative diets. The system of representative diets dates in Poland from the year 1468. Till then they had been summoned to meet at the king's pleasure, and had no regular form, but from that year the diets met regularly, and were attended by two nuncios (*nuncii terrestres*) from each district into which the kingdom was divided. These nuncios were required to receive precise instructions from their constituents, and were not allowed to go beyond them. The diets also included representatives from the towns. This arrangement put for a time the chief power into the hands of the great body of the people; but it did not continue long in force. The nobles gradually succeeded in banishing the representatives of the towns and in regaining all their former influence; so that by the end of the reign of Sigismund I. almost all the guarantees for the liberty of the people had been done away with.

After the extinction of the Jagellon dynasty in 1572 Poland became in fact what it had been in principle ever since the election of Louis of Hungary as king, an elective monarchy. Henry of Valois, afterwards Henry III. of France, was the first of the new series of monarchs. He was elected in 1573, and in 1574 swore to the first *Pacta conventa*, a body of fundamental laws of the constitution, which all subsequent kings were bound by an oath to respect. These consisted in the main of privileges granted to the nobility, but included a provision for guaranteeing complete religious liberty to all sects. This provision was made with the object of securing

peace between the Roman Catholics, who formed the main body of the people, and the Dissidents, consisting of members of the Greek and Armenian Churches, but chiefly of the adherents of different sects of Protestantism, which had made great progress in Poland. When Henry, after a reign of four months, secretly made his escape in order to take possession of the throne of France, Stephen Bathori was in 1575 elected to succeed him. While he reigned there was once more a strong government in Poland. Internally the country was comparatively tranquil, and externally its arms were victorious. The provinces which had been seized from Poland by the Czar of Muscovy were recovered. After his death in 1586 a Swedish prince was elected under the title of Sigismund III. Those who brought about this election had done so with the hope of uniting Sweden and Poland, but Sweden soon broke away from the union, and in consequence of this a war ensued between the two countries, which was not finally concluded till the Peace of Oliva in 1660, in which Poland lost Livonia and Esthonia, and was deprived of the suzerainty over East Prussia. Meanwhile Sigismund III. had died in 1632, and had been succeeded by Ladislaw IV. (1632–48), and John II. Casimir (1648–69). Under the last-mentioned king the political condition of Poland became so completely anarchical that the free veto by which the vote of a single deputy of the diet might negative a proposal in which all the others were agreed was made legal. One great cause of the anarchy which prevailed was the decline in strength of the Dissidents, and their consequent loss of political privileges. Since the reign of Sigismund III. a reaction against the Protestantizing tendency had been in progress, partly in consequence of the efforts of the Jesuits, and partly of the quarrels among the Dissidents themselves. Very many Protestant converts, especially among the leading families of the country, returned to their old faith; and between 1606 and 1620 the Dissidents lost two-thirds of their churches. The Roman Catholics, who now felt their power, began to abridge the privileges which had been frequently confirmed to them, and even to subject them to persecution in violation of the law. Religious and political oppression occasioned the revolt of the Cossacks, who in 1654 placed themselves under the protection of Russia, and in 1667 Smolensk, Kiev, and the land east of the Dnieper were surrendered to the same power. After the abdication of John Casimir the lower nobility effected the election of Michael Wisniowiecki, who reigned from 1669 to 1674. His successor, the brave John Sobieski (1674–96), in the Peace of 1686, confirmed the cessions which had been made to Russia under John Casimir. After his death the throne appeared to be at the disposal of the one who offered most. The Abbé Polignac, on behalf of Louis XIV. of France, sacrificed large sums in order to determine the choice in favour of the Prince Conti. When the Elector of Saxony, Augustus II., had managed to secure his election to the throne in opposition to the French party (1697), he allied himself with Peter the Great of Russia in an attempt to recover Livonia from Sweden, and Poland thus became involved in the Northern war. After the victories of the Swedes the Polish diet, which was tolerably indifferent to the fate of their elective king, deposed him (Feb. 14, 1704), and a few months later elected Stanislaw Leszczynski in his room. Stanislaw continued to hold the throne of Poland as long as the Swedish arms remained in the ascendant; but in 1709, after the defeat of Charles XII. at Pultava, Augustus of Saxony was restored and maintained in possession of the throne till his death in 1733. When this event took place Stanislaw Leszczynski, whose daughter had just been married to Louis XV., with the support of the French, made another effort to regain the throne of Poland, but Austria and Russia were determined to have no ally of France for their neighbour, and induced the principal nobles and prelates of Poland to proclaim Augustus III. of Saxony king, although the people generally were favourable to the pretensions of Stanislaw. The confusion in the country was now greater than ever. In 1717 and 1718, under the reign of Augustus II., the rights of the Dissidents had been still further curtailed, and in 1733 they were formally excluded from all public offices. The most violent passions were thus inflamed in all classes of the people. After the death of Augustus III. in 1763, and the election of Count Stanislaw Augustus Poniatowski in 1764 as his successor, the Dissidents, supported by Russia, Denmark, Prussia, and England, endeavoured at the diet of 1766 to obtain a remedy for their grievances; but although in 1767 a treaty was concluded at the instance of Russia, by which they were restored to a footing of complete equality with the Catholics, the fanatical opposition made to these proceedings by Bishop Soltyk of Cracow and Massalski of Vilna brought about a civil war which plunged the land into the wildest confusion, and caused Catharine II. of Russia to say that Poland was a country into which the three neighbouring great powers had only to lay their hands in order to take out something. Russia took it upon herself to defend the cause of the Dissidents, and in order to resist her influence a confederation was formed in Feb. 1768 at Bar, then a Polish town, but now in the Russian government of Podolia. In these circumstances it appeared to the Austrian court opportune to resume the county of Zips, which had been pledged by Hungary to Poland early in the fifteenth century. By this act it gave Russia and Prussia, the two other great powers contiguous to Poland, a welcome pretext for carrying into effect the long-meditated partition of that country. On the 5th of August, 1772, the three powers concluded a treaty among themselves with that object, and on the 18th of September, 1773, Poland was compelled to give its consent to the first partition, which had already actually taken place, and by which it lost 85,000 square miles. The acquisitions of Austria, which included most of the territories which now form the Kingdom of Galicia, amounted in all to 27,000 square miles. Those of Prussia, the principal of which was Polish Prussia, with the exception of Danzig and Thorn, had an area of 13,415 square miles. And those of Russia, which included, among other districts, Livonia, amounted to nearly 42,000 square miles. What remained to Poland was completely under Russian influence. A patriotic party now began to labour for the restoration of Poland to its former position, and under the impression caused by the revolutionary proceedings in France a reform of the constitution was projected, according to which the elective monarchy and the free veto were to be abolished, and the third estate to be received into the national representation. A new constitution, dated the 3d of May, 1791, was actually framed on these principles, and received the approbation of Prussia. Russia, however, rejected it, and espoused the cause of its opponents, a small section of the nobility, who had on the 14th of May, 1792, concluded at Targowicz a confederation against it. Prussia now abandoned the cause of the republic, and on the 4th of January, 1793, consented to a second partition, by which Russia received nearly 97,000 square miles (including, among other territories, the crown domains of Polish Ukraine and Podolia, and the eastern half of Volhynia), and Prussia 22,500

square miles (consisting mainly of the parts now forming the province of Posen, besides Danzig and Thorn). Russian bayonets compelled the indignant members of the diet to acquiesce in this new dismemberment of their country. The heroic Kosciusko in this situation of affairs became the head of the confederation which was formed at Cracow in March, 1794, for the defence of their country. The battle of Raclawice, April 4, 1794, and the relief of Warsaw, which was besieged by the Prussian army, September 5 and 6, 1794, are the most glorious days in the history of the Polish nation. But it was too late. Without fortresses, discipline, allies, or even arms; surrounded by Russians, Prussians, and Austrians, the Poles could not but succumb in the end. After the defeat and capture of Kosciusko at Maczjewice on the 10th of October, and the fall of Praga, a suburb of Warsaw, on the 4th of November, further resistance was hopeless. The third and complete partition of the country was now agreed upon between Russia, Prussia, and Austria (Jan. 1795), and the mode of dividing the spoil fixed by a triple treaty, signed at St. Petersburg on the 24th of October, 1795. Russia received in all 43,000 square miles (including the duchy of Courland, a Polish fief, the duchy of Semigallia, &c.); Prussia, 21,200 square miles (which included that part of the duchy of Masovia in which Warsaw was situated); and Austria, 17,700 square miles (including the town and the greater part of the Palatinate of Cracow, and other portions). The last king, Stanislaw Augustus, was compelled on the 25th of November, 1795, to sign his own abdication, and to spend the remainder of his days in Russia in the receipt of a pension. He died at St. Petersburg in 1798. To the Poles nothing remained but wounded feelings of national pride, a bitter hate against Russians and Germans, and fruitless appeals to French aid and public sympathy. In all Russia had robbed Poland of upwards of 180,000 square miles and 4,600,000 inhabitants; Austria, of about 45,000 square miles, with 5,000,000 inhabitants; Prussia, of 57,000 square miles, with 2,550,000 inhabitants.

The dismembered country, which now first received internal order from foreign hands, continued in this condition till November, 1806, when Napoleon's victories over Prussia led the emigrant Poles, under Dombrowski, to Posen and Warsaw. By the terms of the Peace of Tilsit (July 9, 1807) the greater part of the Prussian Polish provinces was formed into the duchy of Warsaw, which received a German ruler in the King of Saxony, and at the same time with the French code a constitution similar to the French, by which serfdom was abolished. In this duchy much was indeed done for the elevation of the masses, but the pressure of the war, conscription, and the continental system, prevented the growth of a sound state of prosperity. The Peace of Vienna (Oct. 1809) added West Galicia to the duchy of Warsaw, and the hope arose among the Poles, many of whom had nobly served Napoleon in his wars against Austria and in Spain, that he seriously intended to restore the national independence. How delusive this expectation was first appeared in the campaign of 1812, when it was manifest that all that Napoleon desired was to raise as many troops as possible in the country. The disastrous termination of this campaign brought the duchy to a speedy end. Its administration was at once assumed by Russia, and the congress at Vienna (in 1814–15) decided the fate of the country. 1. The city of Cracow, with its territory (466 square miles), was to be governed by its own laws, as a free and independent republic (see CRACOW); 2, the country on the right bank of the Vistula, with the circle of Tarnopola, which had been ceded to Russia by the Peace of Vienna, was restored to Austria; 3, the circles of Kulm and Michelau, the city of Thorn and its territory, the department of Posen, with the exception of the circles of Powitz and Peysern, and part of the department of Kalisz, as far as the Prozna, excluding the city and circle of that name (these limits were more exactly defined by the boundary-treaty between Russia and Prussia of Nov. 11, 1817), were ceded to the King of Prussia, who united Danzig, Thorn, Kulm, and Michelau with West Prussia, and from the remainder formed the grand-duchy of Posen; 4, all the rest was united with the Russian Empire under the name of the Kingdom of Poland, but with a separate administration, and such a territorial extent as the Russian emperor should see fit. The Emperor Alexander, therefore, assumed the title of Czar and King of Poland, and received homage in Warsaw. Poland, though thus divided, preserved its name and language, as the treaties of Vienna secured to all Poles who were subjects of any of the three powers such an organization as tended to maintain their national existence. A Polish charter was accordingly promulgated (Nov. 27, 1815), consisting of 165 articles, which, if faithfully executed, would have promoted the welfare of Poland. The government of the country was to be vested in a native Pole, as lieutenant of the kingdom, unless one of the imperial princes should be appointed viceroy. This was rendered nugatory by the presence of the tyrannical Constantine as commander-in-chief. Equality of religious sects, personal security, liberty of the press, the entire possession of all employments, civil and military, in the country by Poles, were among the promises of the charter; and these rights were to be secured by a national diet composed of two chambers. But these promises were kept only to the ear; restrictions on the press, arbitrary imprisonment, arbitrary and cruel punishments, insults added to injuries, a solemn mockery of a diet, which was not allowed to exercise any real authority; the violation of every article of the charter by a Russian barbarian; peculation and extortion practised by the inferior officers—these were some of the features of the Russian government of Poland.

The first diet assembled in 1818, and the liberty of the press was abolished by an act of 1819. Another diet was held in 1820, but these meetings were rendered mere ceremonies; they had no freedom of debate, for those members who dared to express opinions unpalatable to the government were banished to their estates, and made to pay the troops that guarded them; it could not refuse supplies; and in 1825 an ordinance was issued by the government abolishing publicity of debate. The resources were squandered to maintain a Russian and Polish army, and Russian governors practised all sorts of extortion; state prisoners were sent into Russia, and imprisoned without trial; respectable citizens were flogged, or made to work in the highways without any charge being specified against them. On the death of Alexander (December, 1825) and the accession of Nicholas a conspiracy broke out in Russia, and, on pretence that it extended to Warsaw, several hundred persons were arrested in Poland, and a commission constituted, contrary to the provisions of the charter, to inquire into the affair. The only discovery of this inquisitorial tribunal, was that secret societies had existed in Poland since 1821. In 1828 a society was instituted for the purpose of gaining over the officers of the army to the cause of independence, and the insurrection of 1830 was the result of its plottings. It appears, nevertheless, that it was immediately occasioned by a sham conspiracy got up by the Russian police, who had thus induced a num-

ber of young men to betray themselves, and crowded the prisons with the victims.

On the evening of the 29th of November, 1830, a young officer entered the military school at Warsaw, and called the youth to arms. They immediately proceeded to Belvidere, the residence of Constantine, about 2 miles from the city, for the purpose of seizing his person. They were joined on the way by the students of the university, and forced their way into the palace; but the prince was concealed in a clothes-press by a servant, until he could make his escape by a secret door. Another party of cadets and students paraded the streets calling the citizens to arms, and they were joined by the Polish troops. The arsenal was seized with 40,000 stand of arms, and the insurrection now became general. On the next morning 40,000 troops and citizens were in arms, and the Russians were expelled from Warsaw. The administrative council was summoned to preserve order, and several of the most distinguished Poles were invited to sit with it. On the 13th of December the prince was allowed to leave the neighbourhood of Warsaw with three regiments of Russian cavalry and two regiments of infantry without opposition. On the 25th of January, 1831, a diet, which had met on the 18th of December in the previous year, pronounced the deposition of the house of Romanov, declaring the throne of Poland to be vacant, and at the same time a government was organized under Adam Czartoryski. Thus far the insurrection was completely successful; but it ultimately failed, as well in consequence of want of unity among themselves, as of the superior strength of Russia. In the battles which took place under Chlopicki, Skrzyneski, and Dwernicki, at Dobre, Stoczeck, Grochow, and Ostrolenka, the Poles fought with boundless courage; but all their exertions were unable to prevent the Russian general Paskievich from advancing upon Warsaw. On the 8th of September, 1831, this city capitulated, after which the remnants of the Polish army either took refuge on Austrian or Prussian territory, or surrendered to the Russians. The final result of this insurrection was only to put the Poles more completely under the government of Russia. The constitution of 1815 was formally abolished, and replaced by the organic statute of February 14 (26), 1832. The Polish army was disbanded, a strong citadel was erected in Warsaw; the people were disarmed, and every effort was made to Russianize the country.

The Polish emigrants, however, did not yet give up hope, and from time to time tried to raise new revolts. Risings did actually take place in 1846, in the parts which had fallen to Austria, Prussia, and Cracow (which last then lost its independence), and in 1848 in Prussia alone, but all these attempts came to nothing. More serious troubles began in Russian Poland in 1860. A meeting at Warsaw of the sovereigns of Russia, Prussia, and Austria, which took place in the October of that year, recalled the memory of the partitions of Poland, and produced throughout the country an excitement which manifested itself in patriotic celebrations. Attempts were made to check this excitement by force; but afterwards Prince Gortchakoff, the governor in Poland, resorted to conciliatory measures, and allowed the Poles to prepare an address to the emperor, Alexander II., praying for the restoration of their national institutions. The emperor treated this address as seditious. Nevertheless by a ukase of the 26th of March, a council of state, formed of Poles, was created at Warsaw, elective councils were instituted in every government and district, and municipal councils at Warsaw and a number of the other principal towns. These concessions were, however, little more than nominal. When the statutes, according to which the ukase was to be carried out, were promulgated, it was found that the governmental, district, and municipal councils had scarcely any functions assigned them. Their decisions might be cancelled by their presidents, whose appointment was in the hands of the government; and the council of state, the members of which were to be nominated by the emperor, was to deliberate with closed doors. The publication of these statutes increased the discontent, which spread from Warsaw throughout the kingdom, and even into the ancient Polish provinces, especially into Livonia, where a rising at Vilna was violently suppressed by the Russian government (August 18, 1861). During the next few months the agitation went on constantly increasing to a large extent, in consequence of the violent and impolitic measures of the Russians. At last the government essayed another step in the way of conciliation. On the 8th of June, 1862, the Grand-duke Constantine, brother of the emperor, was appointed lieutenant of the kingdom, and the Marquis Vielopolski was associated with him as head of the civil government, in which capacity he endeavoured to allay the discontent by furthering the material prosperity of the land. In this he might have succeeded had not he taken other steps which completely counteracted the good effect that his first efforts might have had, and even raised the discontent to a higher pitch than ever. Among other obnoxious acts he ordered a levy of conscripts to be made, a thing which had not been done since the Crimean war; and to make matters worse it was determined that the choice of the conscripts should not be left to lot, but should be in the power of the administration, which thus hoped to get rid of the most turbulent part of the population, and especially of those who had figured in the recent disorders. On the 15th of January, 1863, the recruitment took place at Warsaw by night, and the persons destined to serve in the army against their will were taken to the citadel. On the 22d day of the same month a general insurrection broke out at numerous different points. A central committee was formed at Warsaw to direct the movements of the insurgents. From the beginning of February fighting was going on everywhere. On the 10th of March Langiewicz, who had defeated the Russians at Piaskowa-Scala five days previously, was appointed by the central committee dictator and general of all the insurgent armies; but on the 19th he was defeated and killed at Tagoscie, and his troops were obliged to save themselves by crossing the frontiers of Galicia. On the 17th of June the cabinets of England, France, and Austria addressed separate notes to the Russian government, urging it to grant the principal demands of the Poles; but this attempt at mediation failed; and the proposal of a European conference relative to the affairs of Poland, which was then made, was rejected by Prince Gortchakoff, the Russian minister (cousin of the Prince Gortchakoff formerly mentioned), as an unwarranted interference with the internal affairs of Russia. The war was now carried on without mercy, and with less and less prospect of success on the part of the insurgents. The Russians succeeded in exciting the peasants against their masters, and securing their aid. They first charged them with the duties of rural police, requiring them to watch the public roads and arrest suspected persons, and afterwards promised to those who should assist in pursuing the rebels part of the lands to be confiscated from the smaller nobility and the *bourgeoisie*. In March, 1864, the rising was completely quelled, but not till the insurgents had been terribly reduced in numbers. Many had been executed; thousands had fallen on the field of battle; thousands more had been banished to Siberia; and

after the suppression of the revolt a new band of Polish emigrants went to swell the number of those already scattered over foreign countries. In 1867 a limited amnesty was proclaimed in favour of those who had taken part in the insurrection.

Since 1864 the policy of Russia with regard to Poland has been directed to the complete assimilation of the two countries, but also to the improvement of the condition of the peasant class in the latter country. The measures adopted for this second purpose were, of course, to a large extent, meant as blows against refractory nobles. To measures of this class belong the ukase of November 11, 1866, abolishing (with compensation in the case of private owners) the servitudes, imposts, and monopolies with which 450 towns and villages of Poland were burdened, and that of June 24, 1870, to facilitate the conversion of tenancies of land into private property. The principal measures for the assimilation of Russia and Poland belong to the years 1867–69. In 1867 there was a new administrative division of Poland into ten governments and eighty-five circles; the financial arrangements of the country were brought into harmony with those of Russia; the Polish council of state was abolished; and the affairs of the Roman Catholic Church were subordinated to an ecclesiastical college in St. Petersburg, all direct intercourse between the pope and the Roman Catholic clergy being prohibited. In 1868 the administrative incorporation of Poland with Russia was completed by the ukase of March 12, which placed the officials of the Polish governments under the authority of the directing senate of the empire. The Viceroy or Lieutenant of Poland was left with merely nominal duties to discharge. In this year also even the name of Poland was officially dropped, and replaced by that of Governments of the Vistula. By a ukase of the 8th of July, 1869, the University of Warsaw was thoroughly Russianized, and about the same time it was decreed that Russian should be the sole language used in schools. From this time forth the history of Poland is completely identified with that of Russia.

An excellent work respecting Poland is Rulhière's Histoire de l'Anarchie de Pologne et du Démembrement de cette République (four vols. Paris, 1807). Respecting the first partition of Poland, see Von Dohm's Denkwürdigkeiten (one vol.), Lettres du Baron de Vioménil (Paris, 1808), and Malte Brun's Tableau de la Pologne, ancienne et moderne. See also Salvandy's Hist. de Pologne, avant et sous J. Sobieski (Paris, 1829); Fletcher's History of Poland (8vo, London, 1831); Lelewel's Histoire de Pologne (Paris, 1844); Chodzko's Histoire populaire de Pologne (Paris, 1862); Chevé's Histoire complète de la Pologne (Paris, 1863); and Mickiewicz's Histoire populaire de Pologne (Paris, 1867).

Polish Language.—The uncertainty of the earliest Polish history spreads a deep obscurity over the rise and progress of the language. It is of Slavonic origin, and is more nearly allied to Bohemian than any other tongue. It differs very much from its eastern sister, the Russian language, in the number of its hard consonants. The cultivation of the language early met with a great obstacle on account of the adoption of Christianity, according to the Latin ritual; for the clergy, being the most cultivated order, took possession of the places of honour and the public offices, so that the Latin language became the language of the state, and afterwards, on account of the kings and queens being foreigners, the language of the court, and of all the educated classes also. The language of the country first recovered its rights in the reign of Sigismund, in the sixteenth century, and became in the middle of that century the language of books; it then declined in the seventeenth, but flourished again during the reign of Stanislaw Augustus, and ripened to a maturity of which even the subsequent political changes could not entirely deprive it. In 1801 a society for the preservation of the purity of the Polish language was formed at Warsaw, under the direction of the Bishop Abbertrandi, and in 1802 published the first volume of their transactions. The Russians are now making every effort to supplant it by their own language.

The Polish language is above all things remarkable for its phonetic richness. It contains nine vowels, the sound of *y* (which is represented by *j*), and thirty-five consonants. The alphabet used is the Latin, diacritic marks and combinations being used where that alphabet is defective. The number of these marks and combinations makes the Polish language as spelled appear much harsher in the eyes of a foreigner than it is in reality. The Polish language is indeed said to be the very reverse of harsh, and the most harmonious of the Slavonic tongues. The pronunciation is indeed difficult to a foreigner, but this is solely due to the nice gradations by which the sounds are distinguished. The principal peculiarities of its pronunciation are the following: *c* is pronounced like *ts* in English; *ch* is a strong aspirate, as in German; *cz* is pronounced like *ch* in church; *g* is always hard, as in give; *j*, as already said, is pronounced like *y*; *rz* has a sound compounded of that of *r* and the sound of *z* in the word azure, sometimes almost the same as the latter sound alone; *s'* is sounded like *sh*, but very soft; *sz* is pronounced like our *sh*; *w* has the sound of *v*; *ż* is pronounced like *z* in azure; *ź* has the same sound, but softer. Before the termination *ski* the *w* is not pronounced in proper names; thus, *Poniatowski* is pronounced *Poniatoski*. The consonants *b*, *p*, *l*, and *n* are sometimes softened by the addition of a sound like that of *y* in yes, the *l* and *n* in this case sounding like the Italian *gl* and *gn*. When so sounded these consonants are distinguished by a mark like an acute accent placed above or beside them (*b'*, *p'*, *l'*, *n'*), or by an *i* following them. The latter mode of distinguishing them is used, especially when the sounds in question are followed by a vowel. The consonant *c'* has a sound absolutely peculiar to the Polish language: it resembles that of *t* followed by or combined with a very soft *sh*. The barred *l* (*ł*) has a sound common to the Polish with other Slavonic tongues: it is produced by sounding the letter *l* with the point of the tongue thrown well back in the mouth, and firmly pressed against the palate. Among the vowels *ę* and *ą* are pronounced respectively like the French semi-nasals *in* and *on*; *i* has the sound of *i* in the English word pique; and *y* has a sound resembling that of the German *ü*. The tonic accent in Polish words is nearly always on the second last syllable.

The grammatical forms of the Polish are more numerous than those of any other living Indo-European language. There were formerly three numbers, the singular, dual, and plural; but the dual has been preserved only in the Mazovian dialect. There are three genders, masculine, feminine, and neuter; and seven cases, the nominative, genitive, dative, accusative, vocative, instrumental, and locative. The Polish language thus possesses all the cases of the Sanskrit, except the ablative. The diminutives and augmentatives are much more numerous in Polish than even in Italian. The inflections of the verbs indicate not only persons and numbers without the aid of personal pronouns, but also the genders of the persons speaking, and the persons spoken about. The only tense for which an auxiliary is required is the pluperfect. Besides the distinction of conjugations, there is another according to which verbs are classified as perfect and imperfect, according as they

express a single or a habitual act or event. This immense variety of inflections in Polish permits the use of inversion in the structure of sentences to as great an extent as it is practised in Latin.

The principal dialects of Polish are the Mazovian, which is spoken in the districts round Warsaw; that of Great Poland, which is chiefly spoken in the districts round Posen, Gnesen, and Kalisz, and of which the written language of Poland is a development; the Silesian, spoken to the east of the Oder; the Cracovian, or the dialect of Little Poland; and the Polish-Lithuanian, as distinguished from the Lithuanian proper.

Of the grammars of the Polish language, after that by the Piarist Copczynski, may be recommended those by Bandtke (a new edition, Breslau, 1824), by Mrozinski (Warsaw, 1822), by Muczkowski (Cracow, 1845), by Sierocinski (Warsaw, 1858), and by Malecki (Lemberg, 1863). Of dictionaries, that by Bandtke (Breslau, 1806), and the great one by Linde, are the most valuable. The latter is in six quarto volumes (Warsaw, 1807–14; new edition, 1855–59). A German-Polish Hand-lexicon was published at Warsaw in 1855.

Polish Literature.—The Polish literature reaches back to a more remote period than that of any other Slavonic language except the Bohemian, and in importance far surpasses the other Slavonic literatures, Bohemian, Servian, and Russian. According to Estreicher, author of the Polish Bibliography, it comprises two-thirds of all the Slavonic literature. The oldest monuments of the literature of Poland consist of warlike, historical, political, and religious poems, more especially the last. They have come down to us partly in Polish and partly in Latin, these being probably translations of Polish originals. The most celebrated of those written in Polish is the Bogarodzica Dziewica, a hymn in honour of the Virgin, which the Polish soldiers were accustomed to sing on the eve of battle. It is said to have been composed by Adalbert, archbishop of Prague, at the end of the tenth century, and accordingly at the time when the first Christian king reigned in Poland. The next literary remains of the country are all in Latin, and consist mostly of chronicles written by the monks. The earliest of these date from the twelfth century, and the principal are those by Mart. Gallus (about 1109), Wincenty Kadlubek (died in 1223), and Boguphalus (died 1255), and the chronicle of the popes and German emperors, by Mart. Strzębski or Polonus (died in 1279). The first three of these are contained in Mizler's Collection (Warsaw, 1761). A new edition of Wincenty Kadlubek's Res gestæ Principum ac Regum Poloniæ appeared at Warsaw in 1824, together with Dzierswan's Chronicon Polonorum (of the thirteenth century). After a long period of comparative inactivity literature revived in the fourteenth century under Casimir the Great, the founder of the University of Cracow. The mathematical sciences became especially flourishing, and two Poles, Johannes Glogoviensis (died 1507) and Wojciech Brudzewski (died 1497), the latter the teacher of Copernicus and the author of several astronomical works, were among the most distinguished men of their time in that department. The progress of civilization and culture is still more noticeable in the works of Jan Dlugosz (died 1480), author among other things of a History of Poland, written in Latin, and in the establishment about 1490 of the first Polish printing-press at Cracow.

Under the prosperous reigns of the first two Sigismunds (from 1507 to 1572) Polish was raised to the rank of a written language, and the proper national literature began. Science and scholarship received a large share of attention, and the literatures of Greece and Rome especially were widely studied, but pure native literature was not wanting. Nicolas Rej (died about 1568) and Jan Kochanowski (died 1584) attained eminence as poets, the latter as a lyrist of the highest rank. Piotr Kochanowski, a younger brother of the preceding, is the author of an admirable translation of Tasso's Jerusalem Delivered. Among the other poets of the century were Sęp Szarzynski (died 1581), an edition of whose works was published by Muczkowski at Posen in 1827, and Szymonowicz (Simonides), celebrated both as the author of Polish Idylls, written after the manner of Theocritus, with a natural and easy grace; and as a composer of Latin odes, which earned for him the title of the Latin Pindar. An edition of his idylls (Sielanki) was published at Leipzig in 1837. It was in the sixteenth century also that the first histories in the language of the people were written. These were the works of Marcin and Joachim Bielski, who were followed by Lukasz Górnicki (1535–91), author of a History of the Crown of Poland, published at Cracow in 1637, and again at Warsaw in 1804. There was likewise considerable activity during this period in the theological field, which was due to the introduction and spread of the reformed faith. Controversial works were numerous, and translations of the Bible or part of it were made by scholars on both sides. The first translation of the New Testament into Polish was made by Jan Seklucyan, and was published at Königsberg in 1551. It was intended for Protestants. For the Catholics a translation of the whole Bible was made first by Leopolita, and afterwards by Wujek. The latter was one of the most learned theologians of his time. His translation appeared at Cracow in 1593.

This flourishing period of Polish literature continued through the whole of the sixteenth century and into the first quarter of the seventeenth, and was followed by a period of Jesuit supremacy and literary decline, which lasted till about the middle of the eighteenth century. The decline was only checked for a time by the efforts of some powerful minds, principally of General Zamojski. The original productions of this period are few and unimportant. Translations, on the other hand, are numerous. Thus Crośćinski translated Lucan; Morsztyn, Corneille; the Jesuit Nagurczewski (1719–1811), Homer's Iliad and Virgil's Eclogues. History was perhaps the most flourishing branch of literature, but the historians again resorted for the most part to the Latin language as a literary medium. The names of Kojalowicz, author of the Historia Lituaniæ; and Jędrzey Wegierski (died 1549), author of Slavonia reformata (Amsterdam, 1679), an exhaustive history of the Dissidents in Poland, may be singled out as the chief. Wegierski also did good service as a historian of literature.

After the middle of the eighteenth century the influence of the French civilization was widely felt in in Poland, and prepared the way for the revival of letters. The introduction and spread of this influence were due partly to the fact that numerous Poles of rank, who had gathered about the court of the ex-King Stanislaw Leszczynski in Lorraine, had returned to their native country with the impress of French ideas on them; partly to the encouragement given to French culture by King Stanislaw Augustus; but more than all, perhaps, to the exertions of the Piarist Stanislaw Konarski, who, though not himself an author, was an ardent patron of letters and supporter of the cause of education and learning. The most distinguished authors of this part of the eighteenth century are Adam Stanislaw Naruszewicz, who produced a History of Poland and an excellent translation of Tacitus; and the poet Ignacy Krasicki (1734–1801), the unquestioned head of Polish litera-

ture during his own time. The dramatic literature of this period is tame, being chiefly distinguished by a formal adherence to the laws of the French stage. The literary activity of Poland did not cease after the overthrow of the political independence of the country, but on the contrary increased and took a more healthy direction. It is indeed only since the country lost its independence that its literature has acquired a European importance. From the year 1815 the literary centre of Poland was Wilna, where a number of the most enthusiastic spirits of the country, with Mickiewicz at their head, associated together and endeavoured to propagate the influence of recent English and German literature in opposition to the prevailing French tendencies, and this notwithstanding the fact that most of them, and indeed nearly all the greatest Polish writers of the period, ultimately took up their residence in France. By far the greatest of the poets of the time referred to are Mickiewicz, Slowacki, and Krasinski. Adam Mickiewicz (1798–1855) is chiefly celebrated as the author of Konrad Wallenrod (St. Petersburg, 1828), an epic poem which had a remarkable effect in rousing the national spirit; and Pan Tadeusz (Paris, 1834), another epic of a thoroughly national characacter, giving a faithful picture of common life in Poland; Juliusz Slowacki (1809–49) was equally distinguished as a lyrist and a dramatist, and was also the author of a considerable number of short epics. Zygmunt Krasinski (1812–59) was the author, among other works, of Nieboska komedya (the Infernal Comedy, 1837–48) and Irydion in Rome, in both of which he portrays in mystical pictures the past fortunes of the Slavonic race, and points to the brighter future which he fully believes awaits it. Among the other poets may be mentioned Antoni Edward Odyniec, author of several ballads and historical dramas (among others Barbara Radziwillówna) and translations of Byron's Bride of Abydos, Sir Walter Scott's Lady of the Lake, and Schiller's Jungfrau von Orleans. Novel writing has been much cultivated during the present century among Polish writers, as among those of all other countries. The principal writers who have excelled in this department are Skarbek, Bernatowicz, and Czajkowski. Great efforts have been made within the present century to recover and preserve the ancient popular songs, fables, proverbs, &c., of Poland that have been handed down by tradition from age to age. Careful collections of the popular songs and ballads have been published by Wojcicki (Warsaw, 1836), Waclaw (Lemberg, 1833), Pauli, Lipinski, Roger (Breslau, 1863), and others. The popular legends have been collected and published by Wojcicki (Klechdy, two vols. Warsaw, 1837). In the drama the Poles have been more successful during the present century than they were in previous periods. One result of the repression of the French influence by that of England and Germany was the casting off the fetters by which that species of literature had been bound, and in the freedom which they thus obtained the dramatic writers produced works of greater energy and truth. The principal dramatic writers besides those already mentioned are Jan Nepomucyn Kaminski (died 1855), the translator of Schiller and Calderon; and Fredro, the greatest of the Polish comic dramatists. In other departments of literature there may be mentioned Joachim Lelewel (1786–1861), author of Dzieje polski (History of Poland; Warsaw, 1829), continued under the title of Polska odrajadzająca się (Brussels, 1843), down to the end of the events of 1830–31; Narbutt, author of a comprehensive and accurate History of Lithuania (Wilna, 1835–41); Bandtke, Maciejowski, Bartoszewicz, also historians; Sniadecki, Goluchowski (a disciple of Schelling), and Kremer (a disciple, at least in the earlier part of his career, of Hegel), the principal philosophers; Jarocki, a zoologist; Tyzenhaus, an ornithologist; Czerniakowski, a botanist; and Zeiszner, a geologist. At the present day there are more periodicals published in the Polish language than in any other Slavonic language. In 1874 more than fifty periodicals were published at Warsaw alone. In Prussian Poland the number of periodicals is very considerable. Most of them are popular, illustrated, or agricultural journals. At Posen is published the leading Polish journal, the organ of the Polish deputies to the German Reichstag. It is called the Dziennik poznauski. Owing to the backward state of education in Austrian Poland the periodical press is not so widely developed there as in other parts of Poland. Besides the periodicals published in Polish in the districts formerly composing the Kingdom of Poland, a Polish journal is published in Switzerland, another in England, and a third in the United States. Among the best recent works on the history of Polish literature are the Historya literatury polskiéj, by Wiszniewski (Cracow, ten vols. 1840–57); the Dzieje literatury w Polsce of Kondratowicz (Wilna, two vols. 1852); and the Historya literatury polskiéj w zarysach, by Wojcicki (Warsaw, new edition, four vols. 1859–61). The best bibliography of Poland is that of Estreicher (Cracow, 1870).

POLAR BEAR. See BEAR.

POLAR CO-ORDINATES. See MATHEMATICS.

POLAR EXPEDITIONS. See NORTH POLAR EXPEDITIONS and SOUTH POLAR EXPEDITIONS.

POLARIS (the pole star), the star α of the constellation Ursa Minor. It is at present near the north pole, and many centuries must elapse before precession will cause the north pole to be defined by any other star. Two stars called the pointers, in the constellation Ursa Major (the Great Bear, commonly called the Plough), always point in the direction of the pole-star, and enable it to be found readily.

POLARIZATION. When a particle of a body possesses properties related to a certain line or direction in the body, and when the body retaining these properties is turned, so that this direction is reversed; then if, as regards other bodies, these properties of the particle are reversed, the particle, in reference to these properties, is said to be polarized, and the properties are said to constitute a particular kind of polarization. Thus, we may say that the rotation of a body about an axis constitutes a kind of polarization, because if, while the rotation continues, the direction of the axis is turned end for end, the body will be rotating in the opposite direction as regards space. A conducting particle through which there is a current of electricity may be said to be polarized, because if it were turned round, and if the current continued to flow in the same direction as regards the particle, its direction in space would be reversed. In speaking of the state of the particles of a magnet as magnetic polarization, we imply that each of the smallest parts into which a magnet is divisible has certain properties related to a definite direction through the particle, called its axis of magnetization, and the properties related to one end of this axis are opposite to the properties related to the other end: the properties which we attribute to the particle are of the same kind as those observed in the complete magnet, and in assuming that the particles possess these properties, we only assert what we can prove by breaking the magnet up into small pieces, for each of these is found to be a magnet. See Clerk Maxwell's Electricity.

Polarized light, tensions and pressures in solid

bodies, extensions, compressions, and distortions, and most of all the optical, electrical, and magnetic properties of crystallized bodies are polarizations which do not agree with the above definition. These are said to be 'dipolar' properties. The rotation of the plane of polarized light by magnetism is, like magnetism itself, a unipolar property. For other phenomena to which the term polarization has been applied, see GALVANIC BATTERY, RESISTANCE.

POLARIZED HEAT. Radiant heat and light are found to be analogous in their reflection, refraction, and absorption. (See RADIATION.) Malus and Berard showed that, like light, a ray of heat might be polarized. (See POLARIZED LIGHT.) Forbes in 1834 proved that heat which had passed through tourmaline was polarized in a plane perpendicular to the axis of the crystal, for he found that it was unable to pass through a second tourmaline (the analyzer) when the plates were crossed, although it was transmitted in other positions of the plates. In his experiments he employed Melloni's multiplier and thermopile to measure the intensity of the radiant heat. He found that the analogy between the two agents light and radiant heat is as complete as his experiments were capable of showing, and his results have been fully borne out by other observers.

POLARIZED LIGHT. Rays of light proceeding from the same luminous point and travelling over paths of slightly different lengths, to fall upon a screen together 'interfere' with one another just as two rays of sound might interfere. (See INTERFERENCE.) But it is found that if a ray of light be made to pass through a crystal of Iceland-spar (which causes it to divide into two rays passing through the crystal in different directions), and if the two rays into which it divides be made to fall on the same part of a screen no variation in the relative lengths of the paths of these rays will enable them to interfere with one another, but either of them may be split up into two interfering rays. Experiments of this kind prove that the vibrations of particles of the ether which constitute light are motions at right angles to the direction of their propagation, that is, at right angles to the ray.

A lamina cut from a crystal of tourmaline, its planes being parallel to the axis of the crystal, allows a ray of light to pass through it; but in transmitting the light it modifies it in a peculiar way, for the light is now unable to pass through a second and similar parallel plate of tourmaline in certain relative positions of the two plates. If AB and A′B′ are lines in the two plates of tourmaline parallel to the axes of the original crystals; when AB is at right angles to A′B′ the light transmitted by one plate is stopped by the other; when AB is parallel to A′B′ the light transmitted by one plate is freely transmitted by the other.

Now a common ray of light exhibits the same properties on all sides; but a ray transmitted by a plate of tourmaline, or indeed any reflected or refracted ray of light, exhibits different properties on different sides. Thus, using a plate of tourmaline like that just spoken of as 'an analyzer,' we find that when a ray of ordinary light passes through it normally the intensity of the transmitted light is the same in all positions of the plate; but rays which have already been reflected or refracted lose more intensity in passing normally through the plate in certain positions of the plate than in others. A ray which is wholly incapable of passing through a plate of tourmaline in a certain position is said to be polarized in a plane parallel to the axis of the original crystal. We know that light vibrations are executed at right angles to the ray; in ordinary light the vibrations are executed in all directions in planes at right angles to the ray; but in polarized light the vibrations are all executed in one direction, which is of course at right angles to the ray, but which is also at right angles to a certain plane; this plane is called the 'plane of polarization.' Thus the polarized ray which is incapable of passing through the tourmaline plate consists of vibrations executed at right angles to the plane containing the axis of the crystal. The existence of rays having different properties on different sides was regarded by Newton as a decisive objection to the undulatory theory of light. Huygens, the founder of the undulatory theory, was unable to account for the phenomenon. The vibrations of the ether were supposed by Huygens to be longitudinal, or to be executed in the direction of propagation of the light. Later experimental researches (see the article Light in Watt's Dictionary of Chemistry) and mathematical investigation showed that the vibrations are all executed in planes perpendicular to the direction of propagation, and removed all difficulty in accounting for polarization. The dynamical theory shows that two rays whose planes of polarization are parallel to one another interfere just like unpolarized rays; but two rays whose planes of polarization are perpendicular to one another do not exhibit any phenomena of interference whatever may be their difference of phase. We have enunciated the theory of polarized light which has hitherto been accepted by physicists. It is, however, generally regarded as incomplete. We proceed to describe some of the phenomena which it explains.

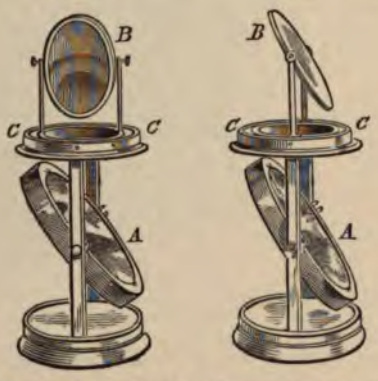
Light may be polarized in any of the following ways:—1. *By reflection* from the surfaces of transparent bodies. A ray reflected from glass at an angle of 54¼° (called the 'polarizing angle') with the normal to the surface is completely polarized in the plane containing the incident and reflected rays. A glass surface parallel to the first is in the best position for reflecting the polarized ray. If the second surface is in such a position that the second plane of incidence (containing the ray and the normal) is at right angles to the first plane of incidence no light is reflected at the second surface. Brewster discovered that the polarizing angle for any medium is that for which the refracted ray is at right angles to the reflected ray, and hence the polarizing angle is the angle whose tangent is equal to the index of refraction of the medium. MM. Biot and Arago and others have determined the following table:—

	Polarizing angle		Polarizing angle.
Fluor-spar	54° 50′	Sulphate of barium	58° 0′
Water	52° 45′	Iceland-spar	58° 22′
Glass	54° 35′	Antimony glass	*64° 45′
Selenite	56° 3′	Chromate of lead	*67° 42′
Rock-crystal	57° 22′	Diamond	*68° 2′

Few substances are capable of completely polarizing light by reflection, and, as a general rule, substances with a high index of refraction polarize incompletely. Brewster says that it is only those substances whose index of refraction is less than 1·7 which polarize completely, those not marked with an asterisk in the above table for instance. When the incident light is bright the polarization is never complete. In general bodies which are bad reflectors polarize nearly all the light reflected. Clean, polished, metallic surfaces polarize very badly indeed. Brewster's rule gives the angle of maximum polarization. Light is polarized more or less at all angles of incidence. The polarizing angle for red light is evidently slightly different from the angle for blue light. Light reflected in the same plane a number of times tends in all cases to become completely polarized. Malus' polariscope is shown in the figures. A ray becomes completely polarized by reflection at the glass plate or bundle of plates (blackened at the back) A, and proceeds verti-

cally to a second plate, B, which is suspended in a frame capable of turning about a vertical axis. A may be called the polarizer, B the analyzer. The angles through which the frame of B is turned may be measured. Each of the mirrors ought to make an angle

Fig. 1. Fig. 2.



of 35¼° with the vertical, and a strong beam of light ought to fall on B at such an angle that it is reflected vertically. If the observer looks at B so as to receive the reflected beam he finds that as the frame of B is rotated there are two positions (differing by 180°) of minimum reflection. They are 90° on either side of the position in which the mirrors are parallel—a position which gives the greatest amount of reflection. The polarization of light by reflection was discovered in 1810 by Malus, a French engineer officer, in examining the light reflected from the windows of the Luxembourg by means of an analyzer of Iceland-spar.

2. *By ordinary refraction.* When light passes obliquely from one medium into another the refracted ray is more or less polarized, its plane of polarization being perpendicular to the plane of polarization of the reflected ray. The polarization of a ray is incomplete after only one refraction; for complete polarization the ray ought to fall not on one plate merely but on a bundle of plates of glass or other medium at the polarizing angle.

3. *By double refraction*, a property common to all crystals not belonging to the regular system. A ray of light entering Iceland-spar, for example, divides into two rays, which have different directions and velocities in passing through the crystal. However in a certain direction, called the optic axis of the crystal of Iceland-spar, there is no double refraction. This axis is parallel to a line joining the obtuse summits of a rhomb with equal edges. Any plane parallel to the optic axis is called a 'principal plane' of the crystal. Now the two rays usually formed by double refraction are found to be completely polarized; one, the 'ordinary ray' (which see), is polarized in the principal plane; the other, the 'extraordinary ray,' is polarized in a plane at right angles to the principal plane. If one of these rays might be destroyed, we should have an excellent means of obtaining a beam of polarized light. Now it is found that tourmaline possesses double refraction, but it absorbs light which is polarized in a principal plane, transmitting only the light which is polarized at right angles to this plane, and hence the use of this crystal as a polarizer or analyzer. In the Nichol's prism (which see) one of the two polarized rays of Iceland-spar is destroyed by internal reflection, the other passing through completely polarized.

Applying dynamical principles to the theory of polarization, it is easy to find the motion of particles of ether when transmitting two or more systems of polarized waves at the same time. Supposing a particle, when transmitting a polarized wave of light, to vibrate in a straight line; when it transmits two polarized waves (of the same wave-length, that is, of lights of the same colour) it combines them into a single wave. Thus if for both polarized waves it vibrates in the same line the resultant wave is polarized, the direction of vibration of the particle remaining the same, but the intensity of the light being altered in a way which depends on the phases of the constituent vibrations. Vibrations in different lines have for resultant a straight-line vibration if the phases of the constituents are the same, or differ by π or 180°; but in all other cases the resultant motion of the particle is circular or elliptic. We see, then, that two polarized rays (which must originally have come from the same luminous point) may combine to form a ray polarized in the same or in a different plane, but that in general, when combined, they form what may be called a ray of circularly, or a ray of elliptically, polarized light. Thus at any instant in a wave of circularly polarized light the ether particles form a circular screw-line, of which the direction of the ray is axis. The polarization is 'left-handed' or 'right-handed' according to the direction of rotation of the particles about the axis. Circularly polarized light behaves in many ways like ordinary light. In a wave of elliptically polarized light the ether particles form at any instant an elliptic screw-line about the direction of the ray as axis. The polarization may, as before, be left or right handed. When examined by means of an analyzer (a Nichol's prism, for instance) an elliptically polarized ray is transmitted with maximum intensity in two positions of the analyzer, and with minimum intensity in other two positions, but it never disappears like plane-polarized light.

In uniaxial crystals (see OPTIC AXIS) the elasticity of the ether seems to be greatest (negative crystals) or least (positive crystals) in the direction of the principal crystallographic axis, but it is equal in all directions at right angles to this axis. It is therefore evident that a wave which depends for its velocity of propagation on vibrations of ether particles parallel to the axis of a negative crystal will travel faster than one depending on vibrations at right angles to the axis. Therefore a ray of light polarized in a plane at right angles to the axis travels faster than a ray polarized in a plane parallel to the axis. Now when a ray of ordinary light falls on such a crystal it sets the ether particles of the crystal in vibration in two planes at right angles to one another; one of these systems of vibrations is transmitted faster than the other, and consequently (see UNDULATORY THEORY OF LIGHT) is transmitted in a different direction. In biaxial crystals the ether elasticity is different in different directions. For the application of the theory of polarization in explaining the actions of uniaxial and biaxial crystals, polarization by reflection at the surfaces of transparent media and metals, &c., we must refer our readers to the article Light in Watt's Dictionary of Chemistry, and to the special treatises of Airy and Verdet.

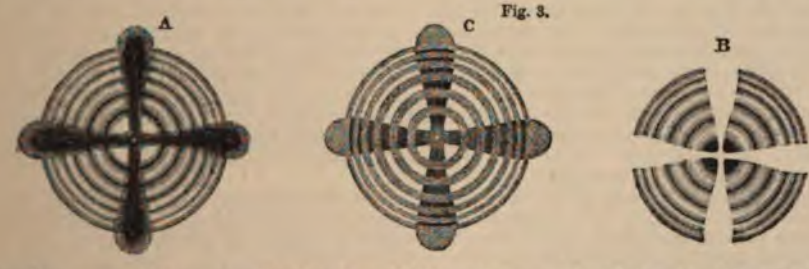
Thin plates of double-refracting crystals when viewed in polarized light sometimes exhibit a most brilliant coloration, the observation of which affords in many cases an easy way of determining the position of the axes of the crystal, &c., and the phenomenon is therefore of very great service in the study of crystalline structure. Let a plate of selenite, $\frac{1}{50}$th inch thick, or a similar plate of mica, be placed between any polarizer and analyzer. Thus it may be placed between two tourmalines or two Nichol's prisms, but we shall suppose it placed at the middle

of the ring C in Malus' polariscope. Suppose A to receive a beam of light which it reflects to B, but which (the selenite being away) is not reflected by B, fig. 1, and which is well reflected by B, fig. 2. Now let the selenite be placed in the path of the light reflected from A and it will be found that B, fig. 2, reflects some of the light which passes through the plate. The selenite, therefore, alters the polarized beam in some way in transmitting it, and this alteration is further shown by the light being coloured. In fact, it has given to some of the tints of white light the power of interference (which see), so that they are destroyed. Viewed by reflection from B the selenite is brightly coloured; if it is of uniform thickness the colour is the same all over. Now, as B, fig. 1, is turned into the position B, fig. 2, a gradual change from a colour to its complementary takes place. Rotation of the selenite merely alters the depth of colour without changing its tint, and in certain positions there is a complete absence of colour. When the plate is not of uniform thickness its colour is not the same everywhere; but whatever may be its colour at any place in the position of the analyzer, fig. 1, it changes to the complementary tint on rotating the analyzer through a right angle to fig. 2. A thin plate of selenite, ground to a thin edge so that it is really a thin prism, shows a series of coloured bands tinted like Newton's rings.

In every position of the thin plate of selenite except two a polarized ray in passing through it divides into two rays polarized in planes at right angles to one another. Let us consider a particular kind of light, red, for example; the two rays, x and y, travel through the plate with different velocities, and on leaving the plate they differ in phase; let us suppose that they differ in phase by half a wave-length; they would interfere and destroy each other, only that they are polarized in different planes; when they fall on the analyzer each of them becomes divided into two, one polarized in such a way that it can be reflected, the other being destroyed. Thus of the red light reflected by the analyzer part belonged to x and part to y, and as these two components differ in phase by half a wave-length if they have equal intensities they destroy one another. Thus no red light appears, and green, the complementary colour, is the predominant tint. This rough sketch of the explanation of the phenomena may induce readers of the articles INTERFERENCE and UNDULATORY THEORY to consult special treatises.

When the thin plate has been cut from a uniaxial crystal at right angles to the optic axis we no longer find it of a uniform colour. We see a system of coloured rings interrupted when the analyzer is in the critical positions of figs. 1 and 2 by a black or a white cross. (See A and B, fig. 3.) With monochromatic light the rings are alternately bright and dark. With white light the appearance is somewhat like Newton's rings. When the analyzer is not near one of its critical positions we find that there are really

Fig. 3.



two colourless crosses; but near a critical position of the analyzer one of these crosses breaks up into rings as C; they coincide in the critical positions. The rings observed in biaxial crystals under similar circumstances are indicated in (the analyzer being in the position, fig. 1) fig. 4. The curves are lemniscates.

Fig. 4.

When the thin plate is turned the whole system of rings turns in the same direction; the black cross separates into two branches, which, when the plane of the optic axes of the plate makes 45° with the planes of polarization in the instrument, become branches of hyperbolas. When the analyzer is in the position fig. 2 the appearances are the same as before; but the crosses are white and the colours of the rings are complementary to what they were before. Fig. 4 represents the appearance in nitre, whose optic axes are inclined at a small angle not exceeding 5° or 6°. When the axes are more inclined only one half of the figure can be seen at once.

Glass in a state of strain exhibits coloration when placed between a polarizer and analyzer, and thus we can investigate the distribution of the strain through its substance. Unannealed glass is in a state of permanent strain. A plate of ordinary glass may be strained by a force applied to its edges by means of a screw. The state of strain may be varied during the examination of the plate by polarized light. The coloration observed when bodies are examined by polarized light is the best test of double refraction.

We shall now consider the very remarkable phenomenon of the rotation of the plane of polarization exhibited in quartz, a few metallic salts, the sugars, camphor, starch, and a great number of other organic substances. A plate of quartz (a uniaxial crystal) cut at right angles to the optic axis exhibits, when placed between an analyzer and polarizer, a system of coloured rings like any other uniaxial crystal; but we find that the centre of the rings, instead of having a black cross, is brightly coloured—red, yellow, green, blue, &c., according to the thickness of the plate.

On turning the analyzer we find each colour appearing in its turn, and then making way for the next of the ordinary prismatic series, from red to violet, or from violet through green to red. Suppose the quartz to be examined by monochromatic light—say that a plate of red glass has been interposed between the polarizer and the quartz. Now let the polarizer and analyzer (A and B) be crossed, as in fig. 1, so that no light is reflected from B, and let the quartz be interposed, we find that a red light makes its appearance, and to destroy this light it is necessary to turn the analyzer through a certain angle. It is evident that the plane of polarization of the light has rotated during its passage through the quartz. The same effects are observed with any other monochromatic light, but the angle of rotation is least for red and greatest for violet light. The angle of rotation is proportional to the thickness of the quartz plate, and if a solution of sugar in a tube with plane glass ends is interposed instead of the quartz, the angle of rotation is found to be proportional jointly to the length of the tube and to the strength of the solution. Some crystals of quartz rotate the plane of polarization in a positive and others rotate it in a negative direction, and hence the distinction between right-handed and left-handed quartz; but the same amount of rotation is produced by the same thickness of quartz on a ray of a given colour whether the rotation is positive or negative. The angles of rotation for the different simple colours are nearly proportional inversely to the squares of the wave-lengths; this law is approximately true for most substances which exhibit rotation of the plane of polarization. The tint produced with a quartz plate 3·75 millimetres thick, when the analyzer is in the position of fig. 2, deserves particular notice. It is a purple tint, which changes very rapidly to red or violet as the analyzer is turned one way or the other. It is distinguished by the name 'sensitive or transition tint.' It is used as the standard tint in measuring the rotations produced by different substances, because of the facility and certainty with which it may be recognized. It is much easier to seize the exact moment when this tint makes its appearance than to determine with certainty the time of disappearance of red, yellow, or any other simple colour.

Faraday in 1845 made a discovery which must be regarded as the most important of his achievements. His discovery of current induction might have been arrived at by applying thermodynamical principles to Oersted's results; but in the discovery of the rotation of the plane of polarization of light by magnetism he had absolutely no previous experience such as would have led him to imagine a connection between magnetism and light. Professor Clerk Maxwell's theory of light as the propagation of an electro-magnetic disturbance in the ether was no doubt suggested by Faraday's discovery, although founded on the agreement between the velocity of light as determined by Fizeau and Foucault, and by means of aberration and a certain ratio, a velocity, well known in electricity. His explanation of Faraday's magneto-optic rotation is not quite satisfactory. We shall describe Faraday's experiments, and then indicate the direction which they have given to Sir Wm. Thomson's investigations. A bar of heavy glass was placed between the poles of a powerful electro-magnet; the two poles were made hollow, and each of them carried a Nichol's prism; one of these prisms passed a beam of polarized light along the axis of the bar of glass, the other analyzed the light after it had passed through the glass. The prisms were first crossed. No current passed round the soft iron of the electro-magnet, and therefore there was no magnetic field between the poles. No light was found to pass through the analyzer; but when a strong current of electricity passed through the wire surrounding the soft iron, and therefore a powerful magnetic field was produced between the poles, light was found to be transmitted by the analyzer, but rotation of the analyzer again produced darkness. Thus Faraday's glass in its normal condition is unable to rotate the plane of polarization of light, but power of rotation is given to it by placing it in a magnetic field. The amount of rotation is proportional to the strength of the current and the length of the path traversed by the light in the glass. The direction of rotation is always the same as the direction in which the current passes in the coils of wire of the magnet. The phenomenon is not so marked in flint-glass as in Faraday's heavy glass; it is observable in all transparent solids and liquids. If the medium has a rotatory power of its own the total effect is equal to the sum or difference of the natural and induced rotations, according as the magnetic force acts with or against the natural rotatory power of the medium. The rotation is greatest when the lines of magnetic force of the field (which see) are parallel to the ray, and Verdet has shown that when the magnetic action is oblique to the ray the rotation is proportional to the cosine of the angle contained between the direction of the ray and the magnetic action or lines of force. Faraday's law, that the direction of rotation is the same as that of the current, was found by Verdet to be true only of diamagnetic substances. Faraday at first attributed the observed effects to the direct action of the magnet on the light, but he was afterwards convinced that the rotation is due to a change in the molecular structure of the medium produced by the magnetism. Hence magneto-optic rotation is rarely developed in crystals, because crystallization interferes with molecular displacement. Hence also the development of this power is hindered by pressure and favoured by heat.

Sir Wm. Thomson seems to have no doubt that magnetic phenomena are due to an allignment of axes of rotation of a very great number of small bodies like gyroscopes. It is well known that a gyroscope quite free to move will place its axis parallel to the earth's axis of rotation. Thomson is rapidly building up a mathematical theory of magnetism on the above basis. He has investigated the relative motions of attached gyroscopes. One of his results is of great interest in connection with magneto-optic rotation. If one end of a cord is fixed to the ceiling, the other end being held in the hand, and if the hand be moved in a straight line, a plane polarized wave will run from the hand along the cord and back again. Thomson has shown that if instead of a cord we have a uniform chain of equal gyroscopes (each gyroscope being attached to its two neighbours by means of equal weightless links), a straight-line motion of the hand sends as before a polarized wave towards the ceiling, *but the plane of polarization rotates as the wave advances.*

POLARS, Reciprocal, the name given to a method of mathematical investigation. If Σ is a given fixed conic section, and if S is a given curve, another curve s may be generated as follows. Draw any tangent to S, and take its 'pole' with regard to Σ (the pole of a line cutting a conic section is the point of intersection of the two tangents drawn at the points in which it cuts the curve), the locus of this point will be the curve s. s is called the 'polar curve' of S with regard to Σ. Σ is called the 'auxiliary' conic. It may be shown that the polar curve of one conic section with regard to another is also a conic section.

POLDER, a class of agricultural lands in Holland

consisting of extensive tracts reclaimed by drainage from what had originally consisted of lakes or morasses, and generally lying below the level of the sea. The transformation of the Lake of Haarlem into a *polder* is a striking illustration of what can be effected through energy and patient perseverance. The usual method of procedure in the formation of a polder is to encircle the portion to be reclaimed by an embankment, and construct a canal having its bed sufficiently high to cause a current towards the sea or river. The water is then pumped into this canal by means of various pumping apparatus, worked for the most part by means of wind-mills, but not unfrequently by steam-power. After the water has been drained off the land is put into the hands of the husbandman, and this kind of soil is in general found to be very productive. The polder, however, is always liable to fresh inundations, and a considerable annual expenditure is necessary to uphold the appliances requisite either to prevent or remedy these. The inundations, unless they are of salt water, contribute for the most part to the fertility of the soil.

POLE, in astronomy, the name given to each of the two points in which the axis of the earth is supposed to meet the sphere of the heavens. In spherical trigonometry, the pole of any circle drawn on the surface of a sphere is one of the points in which the perpendicular to its plane through its centre cuts the sphere. In this sense astronomers speak of the poles of the ecliptic, &c.

In geography, either extremity of the axis round which the earth revolves is called a *pole*, or a *terrestrial pole*. The northern one is called the *north pole*, and the southern the *south pole*. Each of these poles is 90° distant from every part of the equator. See EARTH.

Pole, in physics, the points of a body at which its attractive or repulsive energy is concentrated, as the poles of a magnet, the north pole of a needle, the poles of a battery.

POLE, PERCH, or ROD, in surveying, is a measure containing 16½ feet.

POLE, REGINALD, cardinal, an eminent statesman and ecclesiastic, born in 1500, was the son of Sir Richard Pole, lord Montacute, cousin to Henry VII. by Margaret, daughter of the Duke of Clarence, brother to Edward IV. He received part of his education in a Carthusian convent at Sheen, near Richmond, whence he passed at the age of twelve to Magdalen College, Oxford, where Linacre and Latimer were among his teachers. He obtained his bachelor's degree at the age of fifteen. He entered into deacon's orders at an early age, and had several benefices conferred on him by Henry VIII., with whom he was a great favourite. In 1519 he visited Italy, and fixed his residence at Padua, where he acquired the friendship of several celebrated men, such as Erasmus, Bembo, and Sadoleto. He returned to England in 1525; but in consequence of the affair of the divorce from Catharine of Arragon, withdrew to Paris (1529), under the pretext of continuing there his theological studies. He afterwards went to Avignon, and thence to Italy, where he resided sometimes at Padua, sometimes at Venice. While staying in Italy he was ordered by Henry to give a formal statement of his opinions regarding the divorce and the question of Papal supremacy, whereupon Pole, after trying for some time to escape from this dangerous task, drew up a long and laborious epistle (Pro ecclesiasticæ unitatis defensione), in which he boldly condemned the divorce as unlawful, and the rejection of the Papal supremacy as a breach made in the unity of the church. The consequence of this conduct was the loss of all his preferment in England, in return for which he endeavoured to form a party against Henry, which design terminated in the destruction of his brother, Lord Montacute, and of his aged mother, then Countess of Salisbury, whom the vindictive Henry sent to the scaffold. He was declared a traitor by the king, and a price of 50,000 crowns was set upon his head. But the countenance of the court of Rome was extended to Pole, and besides being raised to the dignity of cardinal, he was employed in various negotiations. He was also appointed one of the three Papal legates to the Council of Trent; and on the death of the pope, Paul III., was all but elected to fill the Papal chair. On the accession of Mary I. his attainder was reversed, and he was invited to England, whither he proceeded in 1554 as legate and plenipotentiary of the Papal see, and where he endeavoured to moderate the rigour of Gardiner and others against the Reformers, and was an advocate for lenient measures, and such a correction of clerical abuses as would conciliate them. On the death of Cranmer, Pole, then for the first time ordained a priest, became Archbishop of Canterbury, and was at the same time elected chancellor of the Universities of Oxford and Cambridge. Immediately on becoming archbishop he put a stop to the persecution in his diocese, and set himself to reform the clergy, to rebuild the churches, and to re-establish the ancient discipline. He died on the 18th November, 1558, the day after the death of Queen Mary, so that he did not live to see his labours for the re-establishment of Romanism rendered fruitless, and the Protestant religion again in the ascendant. He was buried in Canterbury Cathedral with no other epitaph than the brief inscription *Depositum Cardinalis Poli*. Cardinal Pole seems not to have been a man of commanding talents, but he merited great esteem for his mildness, generosity, and comparative moderation, in an age when persecution was deemed lawful on all sides.

POLE-AXE, an axe attached to a pole or handle of which the length varies considerably. It was formerly used by mounted soldiers, and is yet used in the navy for boarding purposes; in the latter case the back of the axe is furnished with a hook.

POLECAT (*Mustela putorius*), a species of carnivorous animals included in the family of the Mustelidæ or Weasels, which in turn forms one of the divisions of the digitigrade section of the carnivorous order of Mammalia. As in the majority of the Mustelidæ, the body in the Polecat is elongated, the legs being short. The muzzle, however, is shortened. The teeth number six incisors, two canines, six premolars, and four molars in each jaw. The skull presents a triangular shape and somewhat flattened conformation. The neck is long and flexible. The ears are of small size, the eyes being large, and the senses of smell, hearing, and sight being very acute. As in the companion genera, and as characteristic of the Weasel family, the anal glands of the polecat—structures placed close to the base of the tail—secrete a fluid or secretion of highly unpleasant odour, and which remains disagreeably permanent when brought in contact with clothing or other material. These animals, comparatively common in Britain, measure in their adult state from 16 to 18 inches—the tail, which is short, measuring from 4 to 5 inches in addition. The under coat is dense, the outer and hairy fur being of a yellow colour, and the tips of the longer hairs being tinged of a dark-brown hue. The edges of the ears and the fur surrounding the lips are coloured white. The young, produced in spring, number from three to five. These animals inhabit burrows, lining the nest with dried grasses or similar material. The food consists of the smaller Mammalia, of birds, and poultry—the Polecat being an inveterate destroyer of domestic fowls and of game.

Like other members of the weasel tribe the Polecats suck the blood of their victims, and leave the bodies and flesh untouched. In this way they become exceedingly noxious, from the immense numbers of animals they destroy. The Polecats, like the otters, appear occasionally to feed upon fishes, a polecat during winter having thus been found to have fished eleven large eels from a river adjoining its burrow. The name of 'Foumart' is also applied to the Polecat; and its fur, which is imported in large quantities from northern Europe, is known as that of the 'Fitch.' From 150,000 to 200,000 of polecat skins are annually sold in the London fur markets alone. The Scotch skins are said to be the finest; and the furs are exported from Britain to America, where they are in repute, to the number of 25,000 annually. Various processes have been adopted in dressing the furs to remove from them the odour of the anal glands, which generally impregnates the fur and flesh to a greater or less degree. (See Pl. XXXI.–XXXII. fig. 18.)

POLENTA, a kind of food common in Italy among the higher and lower classes alike. It consists of a preparation of either Semolina or Indian-corn meal, which, being mixed with water, is allowed to boil until it thickens. It is then poured into a dish, where it becomes firm enough to be cut into slices, in which state, after being variously seasoned, it is eaten.

POLE (or POLAR) STAR is a star of the second magnitude, the last in the tail of Ursa Minor, near the celestial pole. See POLARIS.

POLICE (Greek, *politeia*, government, from *polis*, a city), a judicial and executive system, and an organized civil force for maintaining order and enforcing the laws. There are traces to be found in every organized society from the remotest antiquity of some system of rules for the maintenance of peace and order. We see such traces in the Mosaic laws, and likewise in those of the Egyptians. At the same time, a system of police in the limited and particular sense in which we use the term did not exist in ancient times. In Greece it was mixed up with the totality of their institutions. In Rome not until the time of Augustus do we find the police becoming a special institution, with a numerous staff of various grades of officers, at the head of whom stood the *præfectus urbis*. When the barbarians swept across the Roman Empire and obtained the mastery every trace of a regular system of police disappeared, and only when Charlemagne ascended the throne was there a successful attempt made to re-establish anything of the kind. But after the death of Charlemagne everything fell into confusion again. The Normans, established in the north of France, were the first who made stringent police regulations for the assurance of public tranquillity. In France, previous to the middle of the fifteenth century, the provost of Paris and his lieutenants were charged with maintaining the peace of the city and suppressing vagrancy. About 1446 the city was divided into sixteen districts, over each of which a commissary of police, with a number of officers under him, was placed. In 1577 the privilege of electing their own police magistrates—two for each district—was granted to the inhabitants of the several districts. Under Louis XIV. the police attained its highest measure of perfection as a repressive force. A universal system of espionage was established, and the slightest indication of impatience under the yoke of oppression, or the smallest departure from the monarch's views of what was right, was visited with summary arrest and punishment. In the time of Louis XV. it participated in the general decay and demoralization that had infected the other departments of the government. In 1794 the National Convention reorganized the police and defined its duties, which comprised almost every department of administrative government. During the administration of Napoleon I. the city police of Paris attained a high degree of efficiency. In 1847, under Louis Philippe, the number of the regular policemen, *sergents de ville*, had risen to 1800. As existing at present the French police generally is presided over by the minister of the interior; the departments and communes are under the prefects, sub-prefects, and maires, assisted by commissaries of police, and other municipal agents; Paris is under the prefect of police and his numerous assistants.

In England, from the time of the Saxon kings, there had existed an organization of a partially voluntary character for the repression of crime, the arrest of criminals, and the maintenance of good order. The population was divided into hundreds, and these into tithings, or companies of ten freeholders with their families. The chief man of the hundred was the justice of the peace, or local magistrate, for the trial of small causes; and the head man of the tithing was responsible for good order and the arrest of criminals in his limited district. As this system, however, was not always found to work well, the high sheriff of the county, his deputies, and the constables appointed by the parishes, were eventually substituted for the voluntary officers of the earlier period. But in process of time this system was also found ineffectual for the maintenance of public peace and security; yet no great improvement was made until 1829, when the remodelling of the police system of the metropolis led the way to the adoption of a uniform system for the whole country. In 1829 Sir Robert Peel got an act passed 'for improving the police in and near the metropolis,' a measure which was at once carried out, though it brought down much invective on the head of its originator, and caused many prognostications of evils it was to entail. Such prophecies, however, were soon seen to be baseless, and the measure has been a great means of promoting peace and protecting life and property. Several modifications were introduced by subsequent acts of Parliament, especially by 2 and 3 Vict. caps. xlvii. and xciv. (1839); and other cities and boroughs from this time forward successively acquired, by separate acts of Parliament, the necessary powers to enable them to institute and maintain police on the model of the metropolitan force. In 1839 and 1840 acts were passed providing for the appointment of a county constabulary, organized and maintained in accordance with rules prescribed by the secretary of state for the home department. The county magistrates, however, were left the option of taking advantage of these acts, and accordingly many counties took no steps in the matter. But by 19 and 20 Vict. cap. lxix. (1856) it was made compulsory on the magistrates of every county where no police had yet been constituted to proceed therein forthwith; and accordingly there is now a county constabulary force in every county, which reports annually to the secretary of state, the force being under the periodical inspection of officers appointed by the crown. Some amendments were introduced in 1859.

In Scotland the organization of an efficient police in the large towns dates from 1833, when a statute was passed enabling burghs to establish a general system of police, which, however, was superseded by the act 13 and 14 Vict. cap. xxxiii. (1850). The expense of the police establishments thus introduced is provided for by an assessment on the inhabitants; and the superintendence of the whole system of expenditure and management is intrusted to certain commissioners chosen by the inhabitants paying

assessment. The rural police has been organized under the law of 1857, which is similar in its provisions to the English law of 1856, the duty of establishing a constabulary force for each county being entailed upon the commissioners of supply for the county. Half the expense of the clothing and pay of constables is defrayed by national funds.

In Ireland previous to 1814 the police was in a very disordered condition. In that year a law was passed by which some improvements in detail were effected, but many abuses still continued unremedied. The act of 1836, and its subsequent modifications in 1848 and 1857, have greatly improved the police. It is of a semi-military character, being well armed and occupying barracks. A certain number are mounted. The greater portion of the expense of keeping up the Irish police force falls on the Consolidated Fund.

In the United States the provisions for the repression of crime and the detection and arrest of criminals were copied from those of Great Britain. In 1857 the legislature of New York passed an act for the establishment of a metropolitan police force, which was subsequently modified in 1860. The duties of this force are very much the same as of the London and Paris forces.

POLICINELLO. See PUNCHINELLO.

POLICY OF INSURANCE. See INSURANCE.

POLIGNAC, JULES AUGUSTE ARMAND MARIE, PRINCE DE, a French statesman, born at Paris May 14, 1780. His parents being obliged to leave France at the time of the revolution, he went first to Russia, then a refuge for the royalists, and after that repaired to Edinburgh, where the Count d'Artois, afterwards Charles X., was then residing. In 1803 he returned to France, and took part in the conspiracy of Pichegru and Cadoudal, and in consequence of his complicity in it was condemned to two years' imprisonment. He was still, however, detained in prison after the expiry of his sentence, in company with his brother Armand, who had been more deeply implicated in the same plot; but both succeeded in effecting their escape. After the restoration he took part in the reaction, and rose high in the favour of Count d'Artois. In 1815 he was appointed adjutant-general to the king, and entered the chamber of peers, but at first refused, like his brother, to take the oath to the charter, though he afterwards consented to do so. In 1816 he married Miss Campbell, a Scotch lady, and later, in 1825, he married the Marchioness de Choiseul. In 1820 he obtained from the pope, as a reward for his services to the church, the title and arms of a Roman prince. In 1823 he succeeded Châteaubriand as ambassador at London; but after the accession of Charles X. spent the greater part of his time in Paris. His great attachment to the ultramontane system of Archbishop Latil was probably the reason why Charles X. made him minister. But as little liberty was allowed to discuss the circumstances of the time, the hatred of the nation was directed against him as much as against the house of Bourbon. To remove the odium, he spoke out distinctly in the house of peers in favour of constitutional rule, and, notwithstanding, continued to stand so high in royal favour that in 1829 he was placed at the head of the new ministry, with the portfolio of foreign affairs. The pacification with Greece was his work, and the African campaign his device. On the 27th July, 1830, the hatred of the people was roused to open insurrection by the ordonnances issued on the 25th, and the dynasty of Charles X. was overthrown. He accompanied the king to Cherbourg, and then went to Granville, where he was apprehended and carried first to St. Lo and Vincennes, and then imprisoned in the Luxembourg. The house of peers, unaffected by his defence, and the speech which Martignac made in his favour, condemned him to civil death. He was forthwith taken to Ham with three of his colleagues, and there occupied himself with literature and the education of his children. By the amnesty of 1836 he recovered his liberty, and fixed his residence in England. At a later period he returned to France, and died at St. Germain-en-laye in 1847. An older brother, who is often mistaken for him, followed the same course in politics, and died in the same year at Paris.

POLIGNAC, MELCHIOR DE, abbé, and subsequently cardinal, a French diplomatist, was descended from a distinguished family of Languedoc, and born in 1661. In 1689 he rendered himself conspicuous by his address in the negotiations with Pope Alexander VIII., relative to the articles adopted by the French clergy in 1682. In 1693 the Abbé de Polignac was named ambassador extraordinary to Poland, for the purpose of detaching John Sobieski from the league with Austria, and drawing him over to an alliance with France. On the death of Sobieski (1696) he was employed in endeavouring to effect the election of the Prince of Conti to the Polish throne. His intrigues, though seconded by large bribes, were, however, unsuccessful. On his return to France in 1698 he was banished the court on account of the failure of this mission. In 1710 he was sent to take part in the negotiations at Gertruydenberg, and in 1712 was appointed plenipotentiary to the Congress of Utrecht, and was afterwards minister to the court of Rome. He received his cardinal's hat in 1713. Banished during the regency by reason of his intrigues, he was recalled in 1721, and in 1724 was despatched as ambassador to Rome, which he quitted in 1730, and spent the remainder of his life in France, where he died in 1742. As a writer Polignac is known by his didactic poem, in eight books, against the Epicurean system, entitled Anti-Lucretius, seu de Deo et Natura (Paris, 1747), which has been translated into English, French, and German. See the Histoire du Cardinal de Polignac.

POLISH HISTORY, LANGUAGE, AND LITERATURE. See POLAND.

POLISHING is the name given to the process by which the surface of a material is made to assume the most brilliant appearance of which it is capable. The degree of polish or brilliancy which a given surface can take on is in general proportionable to the hardness of the materal. The article to be polished must first be made quite smooth. To effect this various substances are used, according to the nature of the article. The softer bodies, such as wood, alabaster, ivory, are smoothed by means of glass-paper and pumice-stone; metals, with emery, pumice-stone, and polishing-stones; glass, with sand and emery; and precious stones with emery. When the article by these means has acquired a smooth and uniform surface, the polishing begins. In the case of wood the process is effected by rubbing with French polish (which see). In metals, by polishing-steel or bloodstone, or by discs of wood covered over with leather, and on which pulverized tripoli, chalk, tin-putty, &c., is sprinkled. In glass and precious stones, by tin-putty and lead siftings; in marble, by tin-putty and tripoli; in granite and other hard stones, by tripoli and quicklime.

POLISHING-SLATE, a gray or yellow slate, composed of microscopic infusoria. It is found in large quantities in the coal-measures of Bohemia, and in Auvergne, and is used for polishing glass, marble, and metals.

POLITIANUS, ANGELUS (the Latinized form of *Angelo Poliziano*), a learned and elegant scholar of the fifteenth century, born in 1454 at Monte Pulciano,

in the Florentine territories, whence he derived the appellation by which he is more usually known than by that of *Cinis*, his family name. He was educated at Florence, where he soon acquired great proficiency in the classics and in Hebrew; and studied the philosophy of Plato under Marcilio Ficino, and the philosophy of Aristotle under Argyropulo. The first production which brought him into notice was a Latin poem on the tournament of Giulio de' Medici. He assumed the ecclesiastical habit, and acquired by his accomplishments the favour of Lorenzo de' Medici, who made him tutor to his children, and presented him with a canonry in the cathedral of Florence. In 1484 he visited Rome, and met with a flattering reception from Pope Innocent VIII. After his return to Florence he lectured with distinguished success on the Latin and Greek languages, and likewise on philosophy, attracting a brilliant audience of foreigners as well as Italians. Among the most esteemed of his writings are an Account of the Conspiracy of the Pazzi; a Latin translation of Herodian; and a collection of Greek Epigrams; besides some miscellaneous works in prose and verse, and a drama on the story of Orpheus, printed in 1475. This latter piece was set to music, of which science he was passionately fond. As a Latin writer, he may be reckoned one of the first who introduced that age of revived classical Latinity which forms so prominent a feature in modern literary history. He was an industrious and skilful collator of ancient manuscripts, and gave great assistance to the editors in the early period of typography. He also extended his researches to jurisprudence, and contributed greatly to the correction and illustration of the Pandects. He died in September, 1494.

POLITICAL ECONOMY is the science which treats of the general causes affecting the production, distribution, and consumption of things having an exchangeable value, in reference to the effects of such production, distribution, and consumption upon the national wealth and welfare. The definition of this science has been a subject of some discussion. Senior defines it as 'the science which treats of the nature, the production, and the distribution of wealth;' Archbishop Whately as 'catallactics, or the science of exchanges;' Storch, as 'the science of the natural laws which determine the prosperity of nations, that is to say, their wealth and civilization;' Sismondi, as the science which has for its object 'the physical welfare of man, so far as it can be the work of government;' Say, as 'the economy of society, a science combining the results of our observations on the operations and functions of the different parts of the social body;' John Stuart Mill, as 'the science which traces the laws of such of the phenomena of society as arise from the combined operations of mankind for the production of wealth, in so far as those phenomena are not modified by the pursuit of any other object.' The definition of Malthus gives it a wider range than is conceded to it by M'Culloch, extending it to the investigation of the production and consumption of all that man desires, as useful and agreeable, according to which definition M'Culloch says it would include all other sciences, so that 'the best encyclopædia would really be the best treatise on political economy.' But M'Culloch's definition is liable to the same objection, if taken in its full literal sense; for he calls it 'the science of the laws which regulate the production, distribution, and consumption of those material products which have an exchangeable value, and which are either necessary, useful, or agreeable.' This definition would evidently, if taken in its full breadth, comprehend a very large portion of the encyclopædia. But though Malthus considered the science as comprehending all those things which men desire as useful or agreeable, yet he undoubtedly intends to limit it to certain views of this great variety of subjects. But the definitions both of Malthus and M'Culloch seem to be too broad. Political economy refers only to the general causes affecting the productive faculties and means of a nation, meaning by *productive faculties* and *means* the capacity and resources for producing things that have an exchangeable value. Thus the constitution of government, the laws, the judicial, social, and economical institutions, the schools, the religion, morals, soil, geographical position, climate, arts, indeed all the circumstances in the character and condition of a people, as far as they have a general effect on the public wealth; in other words, the production, distribution, and consumption of commodities are subjects of this science. It is, accordingly, a science of a lofty and liberal character, not identified with that of politics, but very nearly allied to it, and, indeed, one of its branches; for a man would be but ill qualified to legislate for a state who should be ignorant of the general laws affecting its productive capacity. This being the character of the science it is not a little remarkable that it has not been more honoured and more generally studied as a distinct field of inquiry; for it has necessarily been studied and practically applied by all statesmen and rulers from the beginning of time, since the effect of all measures of the government, and all causes, upon the condition of a community must have been objects of consideration from the dawn of human reflection, though the notions of men may have been very crude, and often erroneous, upon this as upon all other sciences. Men very early studied the human body, and even formed something like a science to account for its functions; but correct notions of anatomy are of comparatively recent origin. The science of chemistry is still more recent. That of political economy, like others, has had its stages of progress, and some of its professors consider it now to be placed upon as firm a basis, and reduced to a system of rules as completely demonstrated, as that of astronomy since the time of Newton; while others consider the present state of political economy as far below a full development and demonstration of its principles as the system of the nine mundane spheres, or perhaps the theory of Tycho Brahe, as compared to modern astronomy. It certainly seems to be singular, if the rules whereby a nation may be made to flourish or decay are as well defined and as satisfactorily demonstrated as the theorems of geometry, that they should be so rarely and so imperfectly reduced to practice. Some of the fundamental doctrines of those writers who have occupied the greatest space in the written expositions of this science are not adopted by any nation whatever occupying a respectable rank in the civilized world. This might be accounted for if the doctrines in question were professedly proposed for simultaneous adoption by all nations, like those of the Peace Societies; for then the doctrines might be theoretically true, but yet fundamentally inapplicable in the actual condition of the world. But these doctrines are not proposed as being subject to this condition; they are pressed upon every single people without regard to the conduct of others, and independently of the policy that may be pursued by foreigners. It is not one of the conditions on which they are recommended that nations must be prepared for their reception by an entire revolution in national relations and policy, and that they can have place only in the train of events attending a political millennium; their advocates profess their adaptation to the present state of national rivalships and collisions of interest. It follows that the practical truth of these doctrines is not so demonstratively proved as their

advocates suppose, or that the legislators are not so wise as they should be. In this state of the case, admitting a great deal of corruption, ignorance, and error on the part of those who control the measures of the different civilized nations of Christendom, yet their general concurrence in rejecting these doctrines, even in those two or three countries where they are most confidently asserted and most learnedly inculcated, presents an authority against their practical utility quite as imposing as that of the professors by whom they are so strenuously advocated. This science, like other speculative sciences, commenced in theories; and the discussion and refutation of them still occupies a great share in the recent treatises—a circumstance which of itself shows that it is in rather a rude state, since in those sciences which have reached an advanced state the visionary systems of the first speculators are now mentioned as matters of mere historical curiosity, a formal confutation of which would be superfluous. Unless we should consider the notion of some ancient nations, that plunder was the great source of national wealth, as a theory in this science, the first step in political economy was the theory of the commercial or mercantile system, which taught that a nation could grow rich only by trade, and that its growing rich in this way depended on the balance received in the precious metals on adjusting its accounts with other nations. Neither of these views is entirely visionary, for a nation may gain wealth by carrying on either war or trade upon very advantageous terms. It is assumed, indeed, that all commercial exchanges are only those of equivalent values. But notwithstanding this axiom, an individual merchant or speculator will sometimes make his fortune by exchanging, or, in other words, by buying and selling. And so a nation, if it possesses some very great commercial advantage—like those of the early Spanish traders with the native Americans, who could exchange iron and bits of tin for a much greater weight of gold—may grow wealthy by trade; for the nation may in this way get, for what costs them only a day's labour, what would cost them, or what may be worth to them, five, six, or twenty days' labour. The mercantile system had therefore some foundation in fact and experience; for every one will probably admit that any particular branch of trade may be more or less advantageous to those engaged in it, and to the countries to which they belong, and that one branch may be more advantageous than another. It is said, indeed, that a disadvantageous trade will cease, and it is thence inferred that all those which continue to be carried on are profitable and useful. This is, at least, admitting that there may be a disadvantageous trade, and that some branches may be advantageous will not be disputed. The mercantile system, then, had some foundation; but, like some other theories of political economy, it was carried too far. The science of national wealth, as applied to nations generally, is reduced to very narrow limits, if we suppose it to rest wholly upon the bargains made in foreign barter. The mistake lay in magnifying the relative importance of foreign trade as a part of the causes of national industry and resources, since the annual profit derived thence, even in a very commercial country, does not usually exceed some very inconsiderable per centage of the whole annual production and consumption. But a still more objectionable part of this theory was the supposition that the gain thus derived depended wholly upon the balance received in gold and silver—according to which notion such a country as Mexico, a great portion of the exports of which are necessarily gold and silver, could never grow rich. The more it produced of the very articles the gaining of which alone could make other nations rich, the more demonstrably impossible it was that it should grow wealthy itself. So far, therefore, as the theory referred national growth in wealth exclusively to the receipt of such a balance of trade, and made the growth in wealth proportional to the amount of this balance, it was entirely fanciful. This theory was supported in the latter part of the seventeenth and early part of the eighteenth century, in England, by Mr. Mun, Sir Josiah Child, Dr. Davenant, and Sir James Stuart; but it was called in question at the same period by Sir William Petty, Sir Dudley North, Mr. Barlow, and later by Sir Matthew Decker and Mr. Harris. Sir Matthew Decker's Essay on the Decline of Foreign Trade was published in 1744, and Mr. Harris' Essay upon Money and Coins in 1757. Hume treated of the same subject in his Political Essays, published in 1757. So far, then, as this theory rested upon the notion of a money balance as being the only source of national growth in wealth, it was ably discussed before the publication of Smith's Wealth of Nations. But the practical question at the bottom of the theory, namely, the national advantages and disadvantages of particular branches of trade, and the effect upon a nation of a trade which keeps it always in debt to another, has not been settled to this day; the economists of the *new school*, as it is termed, maintaining that all foreign trade is advantageous to a country precisely to the degree to which it is profitable to those engaged in it, and therefore that the immediate interest of the merchant, under the actual circumstances, is the infallible criterion of the national interest; while others, on the contrary, and with them most legislators, practically act upon the doctrine that the immediate interest of the merchant is not in all cases a criterion of the permanent national interest. See Balance of Trade.

The manufacturing system has been ranked as another economical theory; but it can hardly be regarded in this light. It supposes that a nation promotes its wealth and productive capacity by manufacturing for itself all those commodities for the manufacture of which it is adapted by its climate, agricultural pursuits, and the habits and character of its people. It is not now disputed that manufacturing will contribute to the aggregate value of annual products, as well as agriculture or commerce. The only questions are: 1. What descriptions of manufacturing industry will increase the productive resources of a particular country; and 2. Whether it should be an object of legislation to foster and promote these branches of industry. Those opposed to any such legislative interference—namely, the advocates of free-trade—assume that the national industry, left entirely free, and open to a competition with that of other nations, will infallibly take those channels by which its aggregate results will be the greatest. The foundation of the doctrine of the *let us alone* policy was laid by Adam Smith, since whose time its advocates have assumed it upon the principles by which it is supported in the Wealth of Nations. Smith rests the doctrine upon two propositions:—1. 'That every individual can judge, better than any statesman or lawgiver can do for him, what is the species of industry on which he can best employ his capital;' and 2. 'The study of his own advantage naturally, or rather necessarily, leads every individual to prefer that employment of capital which is most advantageous to society.' The doctrine of free-trade rests wholly upon these two propositions. Our limits will not allow us to consider the arguments in favour or against their soundness as the guides of legislation in all cases. For these the reader is referred to the works mentioned at the end of this article. It is sufficient to remark here

that the doctrine of free-trade, long merely a theory, has been practically adopted in Great Britain.

Another theory in relation to national wealth was that of Quesnay, denominated the *agricultural system*—namely, that agricultural is the only productive sort of labour, since this affords a surplus (to wit, rent) after paying the labourer; whereas, all other kinds only replace the value of the stock and pay the wages. This theory is, however, entirely exploded; and, besides, it is of a kind not calculated to do any practical injury; for no nation would think of legislating upon the assumption that, because the raising of cattle, and thus producing hides, was, according to this doctrine, a productive labour, and that of tanning the hides and making the leather into shoes was not productive, or left no net gain, therefore the two latter branches might as well be discontinued.

These doctrines refer to the general national industry and growth in wealth; others are partial in their application, of which we will notice a few that are adopted by those writers who are the most disposed to consider political economy a science. One of these doctrines, stated by Adam Smith, is, that the wages of common day labour finally fix at the point at which they barely afford the labourer the means of subsistence, and of continuing the race of labourers. This is called by the followers of Adam Smith the 'natural rate of wages.' It is usually assumed in their writings as settled. But it is not pretended that the wages of labour are the same in the different countries of Europe; on the contrary, it is everywhere taken for granted that they are higher in some countries than in others. It would follow from this doctrine that in those countries the necessary expense of supporting and reproducing the labourers is in proportion to the wages paid in them respectively; whereas the fact is quite otherwise. And what entirely confutes the notion of any such 'natural rate' of wages, is that the rate varies in different kinds of labour, in which the expense of supporting, instructing, and reproducing the labourers, is apparently equal. The very statement of this doctrine presupposes a natural rate of expenditure for shelter, clothing, and food, for the labouring classes, a supposition which has no plausibility in theory, and no support in fact. The doctrine of a natural rate of wages of the labouring classes is, indeed, entirely fanciful. It is very true that the present pecuniary interest of those who hire and those who are hired, is at variance, as well as that of those who buy and those who sell; and the party having the greatest advantage in either case will, generally speaking, use it; and, accordingly, where the labourers are poor, thriftless, and improvident, saving nothing, and being obliged to depend upon the earnings of the day for their food, they put themselves very much in the power of their employers. If to this be added a superfluity of labourers, and a want of employment for all, the advantage of the employers is increased, and the labourers will accordingly be reduced to a lower and lower compensation, until, perhaps, at length, the wages paid will not more than supply them with the poorest fare, and the meanest clothing and accommodations. But the degree to which they may be reduced by the operation of these causes will evidently depend upon the situation of the country, the demand at successive times for labour, in comparison with the supply of labourers, and, most of all, upon the character of the labourers themselves. To say that there is some point at which these circumstances are naturally balanced in all countries and all stages of economical improvement at which the 'natural rate' of wages is graduated, seems to be a proposition too fanciful and vague to deserve the name of a theory. But such is the doctrine of some economists.

Another leading doctrine of Adam Smith and his followers grows out of the state of the English poor-laws. It is that all provision by law for the support of the poor is useless and injurious. This doctrine is fortified by Malthus's theory of population. See POPULATION.

A proposition dwelt upon at some length by Say, and carefully inculcated in many other writers on the science of economy, is, that production is not *creation;* that a farmer cannot make corn, nor a weaver cloth, out of nothing. M'Culloch says labour is 'the only source of wealth.' This is one of the doctrines of the economists, from which consequences of some weight are deduced. Now all will, without doubt, agree, that without any materials, or, in other words, without the *earth*, men would not produce wealth; and it may be conceded also, for the purpose of the argument, that the earth, without inhabitants, would have no wealth. But men, being placed upon earth, may produce wealth by working upon the materials supplied by it; and the earth is itself sold in portions as a part of the common stock of wealth, and the men are also sometimes themselves bought and sold, as being a part of the same stock. In general, two things must concur in order to the production of value, namely, the thing to be wrought or used, and a person to work or use it. To insist that one or the other is the exclusive *source* of value, seems to savour more of the obsolete metaphysics of the schools than of practical speculation. The utmost that can be made out of it is a merely verbal distinction. And one would hardly expect so trivial a subtlety to occupy much space in a branch of knowledge holding the rank of a science.

All writers agree in the doctrine that security of property is essential to the accumulation of the products of labour, that is, wealth, for no one will save what he has no reasonable assurance that he shall enjoy; and it is also agreed by all that accumulation, that is, a stock on hand, is necessary to the productiveness of labour.

Adam Smith lays great stress upon the division of labour, as one of the causes of the great productiveness of industry. His remarks upon this subject are just, with the qualification, perhaps, that he overestimates the importance of the principle, since he attributes to it the improvements made in various processes of industry, whereas many of the improvements are themselves the causes, or rather afford the means of a separation of employments. Any machine is an illustration of this remark.

It is asserted by some of the writers on this science, that there are no limits to the beneficial effects of the accumulation of capital upon the productiveness of the industry of a nation; or, in other words, that a given number of people, however small, can advantageously employ any amount of capital, however great. But if we assume a certain number of employments and professions, there is certainly a limit beyond which no additional stock and materials could be employed. The proposition may mean that the ingenuity of men can, or will, find out modes of employing advantageously any amount of capital that can be accumulated by them. The proposition thus stated is at least a theoretical one; but the inquiries and investigations to which it leads are certainly not sterile of useful results.

All the products of industry are divided among the persons by whom the taxes are received and consumed, the holders of sinecures, the capitalists,

and the labourers, including in this latter class all the industrious in all professions and pursuits. A great problem in political economy is to determine the mode of distribution most advantageous to the nation; and this problem, which is very general and very complicated in its details, has not yet been fully solved. It is generally agreed that all absolute sinecures, whether under the government or otherwise constituted, are prejudicial. What distribution among the usefully employed, or what comparative remuneration for the labour or services of the respective classes and professions, is the most advantageous, is a subject very little discussed by the writers on economy. But the question as to the distribution between the capitalists, who are entitled to profits, and those who labour upon or with the capital, who are entitled to wages, is a subject of considerable speculation in the books. One doctrine is, that where profits are highest, accumulation will be most rapid; that is, the greater the mass of the annual products that go to those whose capital supplies the materials and instruments of labour, the more rapid will be the growth in wealth. This is assuming that nothing will be saved by the labourers, or not so much in proportion as will be saved out of the profits. The first assumption cannot be made, and the second is questionable.

Economists generally agree in the definition of *value*, as being determined by the amount of marketable things for which an article can be exchanged. It is also well settled that demand determines the market value; but some assert again, or at least seem to imply, that value and cost are synonymous. They also generally imply, by the mode of using the term *cost*, that it is some definite, fixed quantity. This use of language throws great obscurity on their speculations on this subject, since the cost of producing an article varies from week to week by the variation of the price of the materials and the wages; and the same kind and quality of articles will, at the same time, cost one producer more than another. The proposition that cost regulates value is laid down by the writers with great solemnity, and inculcated at great length. It is a subject on which there certainly is a great deal of unprofitable prolixity in the books; for what argument or illustration is necessary to establish the proposition, that men will not continue long to produce an article by which they lose money? The proposition seems to stand in quite as great need of an apology for stating it, as of a disquisition to explain or support it.

Ricardo's theory of rent finds a place in most of the more modern treatises on political economy. Malthus and West first called attention to the fact that the land last brought into cultivation paid no rent, whereupon Ricardo founded the theory that rent resulted from the different productiveness of different soils, superiority of situation, and other differentiating causes, and that if there was no difference in the productive qualities of all the parts of the whole territory of a nation there would be no such thing as rent. His theory is controverted by Dr. Chalmers and others, but is still generally received by political economists. The result of Ricardo's theory of rent, which is most esteemed by the political economists of his school, is the elimination of rent from among the constituent elements of the cost of production.

Passing over what relates to consumption (which see), the above are some of the leading doctrines and theories of what is called the science of political economy as taught by recent writers in Britain and France, a science of which Adam Smith is said, by its professors, to be the founder. There are many useful truths which pass under the name of political economy; but a large proportion of the treatises instead of following in the footsteps of Adam Smith, the true founder of the science, seem to bear the same relation to an intelligible practical development of the causes and phenomena of national growth, wealth, and decline that alchemy does to modern chemistry.

For other branches of political economy see BANK, BOUNTY, CURRENCY, CAPITAL, COLONY, COMMUNISM, COMMERCE, CONSUMPTION, CORN LAWS, CREDIT, DEBTOR AND CREDITOR, DEMAND AND SUPPLY, EXCHANGE, LABOUR, LOTTERY, MONOPOLY, PATENT, PHYSIOCRATICAL SYSTEM, RENT, VALUE, &c. The following are some of the principal works on political economy: Stewart's Inquiry into the Principles of Political Economy (three vols. London, 1767); Turgot, Recherches sur la Richesse et l'Origine des Richesses nationales (Paris, 1774); Le Trosne, De l'Ordre Social (Paris, 1777); Adam Smith's Inquiry into the Nature and Causes of the Wealth of Nations (two vols. London, 1776; new edition by M'Culloch); Say's Traité d'Économie Politique; Sismondi's Nouveaux Principes d'Économie Politique (two vols. Paris, 1818); Ricardo, On the Principles of Political Economy and Taxation (new edition, London, 1819); Malthus' Principles of Political Economy (London, 1820); Senior's Lectures on Population (1831); Henry Carey's Principles of Political Economy (three vols. Philadelphia, 1837–40); John Stuart Mill's Principles of Political Economy (two vols. London, 1848); Fawcett's Manual of Political Economy (London, 1869); W. Stanley Jevons's Theory of Political Economy (London, 1871), &c. Among the books of reference on this subject may be mentioned, The Literature of Political Economy, by J. R. M'Culloch (London, 1845); and Dictionnaire de l'Économie politique (two vols. Paris, 1852–53).

POLITICAL OFFENCES are those offences considered injurious to the safety of the state, or such crimes as form a violation of the allegiance due by a subject to the recognized supreme authority of his country. In the ancient times of the Roman Republic offences of this nature were comprehended under the name *perduellio*, and were considered equivalent to making war upon the state. The term was commonly applied to cases of a general betraying or surrendering an army to the enemy, to conspiracy against the state, attempts to obtain kingly power, or aiding in any way the common enemy. Offenders were tried by two judges, called *Perduellionis Duumviri*, and if convicted were put to death by hanging, or by being thrown from the Tarpeian Rock; the accused had, however, the right of appeal to the people, in early times the populus, later the comitia centuriata, as was done by Horatius. In later times the term perduellio seems to have almost fallen into disuse, and the terms *majestas*, *crimen majestatis*, *crimen læsæ*, *imminutæ*, *diminutæ*, or *minutæ majestatis* were substituted. All those were guilty of majestas who effected, aided in, or planned the death of one having military command or civil authority; who lost an army, who excited sedition, or who by bad conduct in administration impaired the dignity of the state. Under the empire words or acts disrespectful to the emperor were included. In modern times the crimes considered political offences have varied at different periods and in different states. In England the most serious political offences are termed treason (which see), and those of a lighter nature, which do not aim at direct and open violence against the laws or the sovereign, but which excite a turbulent and discontented spirit which would likely produce violence, are termed sedition. (See SEDITION.) Political offenders of foreign countries are by English law not included in extradition treaties, and by the 33 and 34 Vict. cap. lii. (1870),

the secretary of state may if he sees fit order at any time a fugitive criminal accused or convicted of such crimes to be discharged from custody. In the United States also, and in most of the countries of Europe, the extradition treaties do not include the giving up of political offenders.

POLITICS, in its widest extent, is both the science and the art of government, or the science whose subject is the regulation of man in all his relations as the member of a state, and the application of this science. In other words it is the theory and the practice of obtaining the ends of civil society as perfectly as possible. In common parlance we understand by the politics of a country the course of its government, more particularly as respects its relations with foreign nations; and the more important these relations are (as, for instance, in European states, which exert so powerful an influence on each other), the more prominent is the place which they hold in the ideas conveyed by the word; whilst in kingdoms whose relations to foreign countries are comparatively unimportant, the word in common usage is naturally more confined to the principles and operation of the internal government. Politics, therefore, extends to everything which is the subject of positive laws, for it is by means of these that the purposes of a state or civil union are effected. The political relations of men have therefore always been the engrossing subject of history.

POLIZIANO. See POLITIANUS.

POLK, JAMES KNOX, President of the United States of North America from 1845–49, was born in 1795, in the county of Mecklenburg, North Carolina. His ancestors, whose name was originally Pollock, emigrated from Ireland early in the eighteenth century. Though his father was a farmer in moderate circumstances, the son was sent to be educated at the university of his native state, where he distinguished himself by his industry and talent, and more especially by his attainments in mathematics and the classics. He afterwards studied law in the office of Felix Grundy of Tennessee, a talented lawyer and statesman. He was called to the bar of Tennessee in 1820, and in 1823 became a member of the legislative assembly of that state. In 1825 he became a member of the House of Representatives at Washington, and immediately distinguished himself as a zealous democrat. He vigorously opposed the administration of President Adams; and on the presidentship of his friend, General Jackson, became one of the firmest supporters of his party. In 1827 he was appointed a member of the committee on foreign affairs, and in 1832 a member of the committee of finance, when he protested at the head of the minority against the renewal of the bank privilege. For this reason he was strongly opposed by the supporters of the bank, who endeavoured to prevent his re-election for Tennessee; but he gained it by a large majority. In 1835 he was appointed speaker of the House of Representatives; and in the same post, during an extraordinary meeting of Congress, summoned by President van Buren, conducted himself with so much impartiality as to gain the approbation even of his opponents, and obtain a unanimous vote of thanks from the house. In 1837 he became speaker for the third time, and retained the office till 1839, when he was elected Governor of Tennessee. He now came forward as candidate for the office of vice-president, but owing to a reaction in favour of the whig, and in opposition to the democratic party, about 1841, both lost the election and was deprived of his governorship. He now retired into private life, till the democratical convention, held in Baltimore in 1844, invited him to offer himself as president. In the contest which ensued he signally defeated his distinguished competitor, Clay. During his presidency the war with Mexico terminated, by the accession of New Mexico and California with its gold-fields to the United States territory, and the dispute with Great Britain as to Oregon was happily arranged. In 1849 he was succeeded by President Taylor, and in the course of the same year died at Nashville. His talents were by no means of the first order, but he was a good man of business, and was generally esteemed for his integrity.

POLKA, a favourite dance of recent times, of Bohemian or Polish origin, the name being derived from the Bohemian *pulka*, half, from the half step that characterizes the dance, or from *Polka*, a Polish woman. It was introduced at Prague about 1835, and in 1839 was brought by a part of the musical band of the Prague sharpshooters, under the management of Pergler, to Vienna, where both the music and dance met with extraordinary acceptance. In 1840 it was received with the greatest applause at the Odéon Theatre in Paris, and was soon the favourite dance at all the public and private balls of that capital. It spread rapidly into every country of Europe, and is now common in every part of the civilized world. The music is written in $\frac{2}{4}$ time, the first three quavers being generally strongly accentuated.

POLLACK, or POLLOCK (*Merlangus pollachius*), a species of Teleostean fishes, included in the suborder Anacanthini, and belonging to the Gadidæ or Cod family. The Pollack forms a species included in the genus Merlangus, or that represented by the Whiting (*Merlangus vulgaris*); the members of this genus possessing three dorsal fins and two anals. The Pollack is sometimes locally known in Scotland by the name of Lythe. It is nearly related to and resembles in general shape the smaller and more familiar 'Podley' (*M. carbonarius*) or Coal-fish, which is caught in such quantities by the youths of every seaport town. The lower jaw is longer than the upper jaw, and the tail is forked, but not very deeply. The flesh of the Pollack is said to be inferior only to the whiting. It inhabits the Atlantic Ocean, and is common on all the British coasts, as well as on the shores of Norway. The northern coasts of Britain appear to be those on which these fishes are most abundant. The Pollacks are gregarious in habits, and swim in shoals. They are caught with a variety of baits, but are most frequently captured with a white-fly, or with a bait formed of any piece of white rag or other material; these fishes greedily seizing such objects. They are common in the Mediterranean in winter.

POLLAN (*Coregonus Pollan*), a species of Teleostean fishes, properly included in the family of the Salmonidæ or Salmons, but frequently and popularly referred to other divisions of the order Teleostei. This fish is sometimes popularly known as the 'Fresh-water Herring.' It is an Irish species, and is found in Lough Neagh, Lough Derg, and Lough Erne. The pollan was first described by Mr. W. Thompson as a distinct and separate species from others, occurring in Scotland at Lochmaben, and in the Cumberland Lakes. The name 'pollan' appears to be a local appellation. Large shoals of these fishes appear on the coasts of Ireland in spring, summer, and autumn, and these are captured by means of nets sometimes in immense numbers. In 1834 it is related that in a short period, and in three or four draughts of the net, 140 hundreds of these fishes—numbering 123 fish to the hundred, or amounting to 17,220 fishes in all—were readily taken. These fishes are sold in Belfast in the fresh state, and at the same time at which fresh herrings are sold in the streets and markets. The body of the pollan averages generally about 9 or 10 inches

in length. Two dorsal fins exist, the hinder dorsal being small and pointed. One anal fin is represented. In Loch Lomond a fish is caught called the '*powan*,' or local *fresh-water herring*.

POLLARD, the name given to a tree the head of which has been lopped off about 8 or 10 feet from the ground, in order to induce it to send out bushy shoots, which are cut periodically for fuel, fencing, or other purposes. The pollard assumes a very formal shape, contrasting disagreeably with trees which have been allowed to assume their natural shape; and their round overshadowing tops in a hedge-row are very injurious to the crops of the adjoining fields. By selecting a leading shoot, and cutting away all the others, the pollard, if not too old, may be converted into an ordinary tree.

POLLEN, in botany, the powdery matter contained in the anthers of a plant, consisting of small cells developed in the interior of other cells. The cavities formed in the anther are surrounded by a fibro-cellular envelope, and within this are produced large cells containing a granular mass, which divides into four minute cells, around which a membrane is developed, so that the original cell (the parent pollen utricle) becomes resolved into four parts, each of which forms a granule of pollen. The four cells continue to increase, distending the parent cell, and ultimately cause its absorption and disappearance. They then assume the form of perfect pollen grains, and either remain united in fours or multiples of four, or separate into individual grains, which by degrees become pure pollen. Occasionally the parent cell is not completely absorbed, and traces of it are detected in a viscous matter surrounding the pollen grains. In Orchidaceous plants the pollen grains are united into masses or pollinia by means of viscid matter. Pollen grains vary from $\frac{1}{300}$ to $\frac{1}{700}$ of an inch, or less, in diameter. Their most common form is ellipsoidal, more or less narrow at the extremities. See BOTANY.

POLLENZA, a town of Spain, in the north of the island of Majorca, 28 miles north-east of Palma. It has good and well-paved streets, a town-house, hospital, asylum, prison, and primary schools; a fine Jesuits' college, partly ruinous, the church attached to which is one of the best of the class in Spain. The port and bay of Pollenza are a few miles north-east, defended by the castle of Albercuix. Manufactures of linen and woollen tissues, plain cloths, charcoal, and soap. Pop. 6400.

POLLIO, CAIUS ASINIUS, a Roman of plebeian family, born B.C. 76, is known from the part he took in the political events of his time, but still more by his writings and love of literature. In the civil war he, B.C. 49, adhered to Julius Cæsar, whom, after defeating Caius Curius in Africa, he accompanied to Pharsalia, and then to the African and Spanish wars. He was afterwards appointed prætor, and held the government of Thither Spain, where he heard of Cæsar's murder, and fought, but without success, against Sextus Pompeius. When Lepidus and Antony were reconciled, in B.C. 43, he joined them with three legions, and proceeded as legate of the latter into Transpadane Gaul. At this time he became the friend of Virgil. After obtaining the consulship he commanded in Illyria and Dalmatia, and for his victories was honoured with a triumph B.C. 39. He afterwards devoted most of his time to literary pursuits, but acted both as a senator and an advocate till A.D. 4, when he died at his Tusculan villa, at the advanced age of eighty. His works, consisting of speeches, tragedies, and a history of the civil war in seventeen books, which was much esteemed, have all been lost. Besides writing well himself he was a great patron of literary men. He is said to have founded the first public library at Rome.—CAIUS ASINIUS POLLIO, surnamed Gallus Salonius, son of the former, became consul B.C. 8. He wrote a work which has been lost, drawing a comparison between the eloquence of his father and Cicero, and giving the preference to the former. He was murdered in the thirty-third year of our era, by Tiberius, who hated him for his freedom of speech, and also for having married Vipsania Agrippa, whom Tiberius had divorced for Julia the daughter of Augustus.

PÖLLNITZ, KARL LUDWIG, BARON, a writer of witty and interesting memoirs, was born at Issomin, near Cologne, in 1692. His father's position as minister of state to the Elector of Brandenburg, and his own brilliant accomplishments procured him admission to courtly circles; but his restlessness, extravagance, and profligacy soon brought him into difficulties, and reduced him to the condition of a soldier of fortune. He served successively in the Austrian, Papal, and Spanish armies; but failed in obtaining any profitable appointment. At last he attracted the favourable notice of Frederick the Great, who appointed him his reader, and afterwards director of the theatre at Berlin. After having from interested motives twice gone over from Catholicism to Calvinism he proclaimed himself a member of the Romish Church shortly before his death, which took place in 1775. Among the literary works ascribed to him are La Saxe galante, which brought him most fame; but which was afterwards discovered to be a bare-faced plagiarism, of the joint production of Larochefoucauld and Mme. La Fayette, entitled La Princesse de Clèves; his amusing Lettres et Mémoires, et la Relation de ses premiers Voyages; État abrégé de Saxe sous la règne d'Auguste III. (Frankfort, 1734); Histoire secrète de la Duchesse d'Hanovre, épouse de George I. (London, 1732); and a posthumous work brought out by Brunn, Mémoires pour servir à l'Histoire des quatre derniers Souverains de la Maison de Brandebourg (two vols. Berlin, 1792).

POLLOK, ROBERT, a Scottish poet, was the son of a farmer in the parish of Eaglesham, Renfrewshire, and born there in 1799. Having shown a decided predilection for literary studies, it was resolved to educate him for the ministry, and accordingly, after attending the University of Glasgow, he entered the divinity hall of the Secession Church, under Dr. Dick, and was licensed as a preacher by the Associate Presbytery of Edinburgh in the spring of 1827. In early youth he had made various attempts in prose and verse, including three tales on the persecutions of the Covenanters, which were published anonymously. Just before receiving his license to preach he had completed his poem of the Course of Time, comprising ten books in blank verse, and describing the history of the human race, as supposed to be narrated by a celestial bard to a wanderer from one of the worlds in space. It displays undoubtedly considerable fervour of language, and the tribute may certainly be accorded of great earnestness of purpose, expressed in language which, if not majestic, is at least chaste and solemn. But it is sadly deficient in imaginative power; and many of the reflective passages, which engross a large part of the work, suggest strongly the idea of sermons rendered into blank verse. By some of his warmest admirers Pollok was raised to the level of, and even made to occupy a more exalted position than Dante or Milton. The author, however, never lived to enjoy the homage which his work called forth, the excitement and labour of composing it having brought on consumption. Shortly after its publication decided symptoms of pulmonary disease began to manifest themselves; a removal to Italy was recommended; and the nume-

rous friends whom his talents and virtues had secured for him were ready to provide the means for effecting this object. But his strength was unable to undertake so lengthened a journey, and he accordingly proceeded no farther than Southampton, taking up his abode at Shirley Common, in the neighbourhood of that town. Here he peacefully expired on the 15th September, 1827, and was interred in the churchyard of Millbrook, where a monument has been erected over his grave. A life of him was published by his brother in 1843. More than twenty editions of his Course of Time have been published, both in this country and in America.

POLLOKSHAWS, a burgh of barony and town, Scotland, county of Renfrew, 2½ miles south-west of Glasgow, on the White Cart, and on the Glasgow, Barrhead, and Kilmarnock Junction Railway. The railway, along with the tramway-car system, affords ready communication with Glasgow at all hours. The inhabitants are principally employed in the manufacture of cotton fabrics, iron founding, engineering, paper-making, dyeing, the manufacture of earthenware, chemicals, &c. Pop. (1881), 9363.

POLL-TAX, a tax levied on all members of the community, the very poorest excepted, the same as capitation tax. (See CAPITATION.) This tax was first levied in England in 1377 and 1380, to defray the expenses of the French war; its collection in 1381 led to the insurrection of Wat Tyler. The amount payable was three groats for each person, male and female, above fifteen years of age. The tax was farmed out to tax-gatherers in each county, who levied the money with great rigour. The first disorder was raised by a blacksmith in a village of Essex, whose daughter had been insulted by the collector. The father dashed out the ruffian's brains with his hammer; the by-standers applauded the action, and exclaimed that it was full time for the people to take vengeance on their oppressors. The rebellious spirit soon spread into the counties of Kent, Hertford, Surrey, Sussex, Norfolk, Cambridge, and Lincoln, and in a short time 100,000 men, under leaders known in history as Wat Tyler, Jack Straw, Hob Carter, &c., marched upon London. After some hesitation the king (Richard II.) agreed to hold a conference with Tyler, who is said to have drawn his dagger in the king's presence, an act which cost him his life. He was struck down by Walworth, mayor of London, and his followers dispersed at some fair words addressed to them by the king, and a promise that slavery should be abolished, that there should be freedom of commerce in market towns without toll or impost, and a fixed rent on lands instead of the services due by villainage, together with a full pardon for all concerned in the rising. This promise was very badly kept; many of the rioters were put to death without the form of a trial; the charters of enfranchisement were revoked by Parliament, and the people were reduced to the same miserable condition as before. The hearth-money of the reign of King William III. was virtually a poll-tax, and was equally unpopular, though it led to no outbreak.

POLLUX. See CASTOR AND POLLUX.

POLLUX, JULIUS, a Greek sophist and grammarian, born at Naucratis, Egypt, about the year 135 A.D. He went to Rome during the reign of Marcus Aurelius, and rapidly acquired so considerable a reputation that that emperor appointed him one of the preceptors of his son Commodus. He wrote several works, all of which have perished except his Onomasticon, dedicated to Commodus, and therefore published before 177. Each of the ten books into which this work is divided forms a separate treatise by itself, and contains the most important words relating to certain subjects, with short explanations of their meaning. The words are not arranged alphabetically, but are given with little regard to rigorous system of any kind, according to the subjects treated of in each book. The best editions are those of Lederlin and Hemsterhuis (Amsterdam, 1706), Dindorf (Leipzig, 1824), Bekker (Berlin, 1846).

POLO, GASPAR-GIL, a Spanish poet, born at Valencia about 1517. His inclination for poetry led him to abandon the profession of law, and his first works placed him among the best Spanish poets of his time. His reputation was established by his Diana Enamorada, a pastoral romance, partly in prose and partly in verse, intended as a continuation of the Diana of Montemayor. In invention Gil Polo is not inferior to his predecessor, whom he surpasses in purity of style, and in the harmony and brilliancy of his verse. He died in 1572. Cervantes excepts the Diana of Gil Polo from his list of works condemned to be burned. It ran through nine editions in fifty years, and has been twice translated into French and English, and once into Latin.

POLO, MARCO, the celebrated Venetian traveller, was born about the year 1256. His grandfather, Andrea Polo, a patrician of Venice, and of Dalmatian descent, had several sons, who, according to the prevalent custom of the republic at that time, devoted themselves to commerce—Marco, called *Il Vecchio*, to distinguish him from his nephew the traveller, settled in Constantinople, and had also a commercial establishment at Soldaya, or Soudach, on the Black Sea; Nicolo (the traveller's father), and Matteo, often incorrectly called Maffeo. The two latter shortly before Marco's birth set out on a mercantile expedition, visiting Constantinople, Soudach, and Bolghâra (Bulgar) on the Volga, the capital of Barkaï, Khan of Kiptchak. After a year's sojourn in this city they travelled round the north coast of the Caspian to Bokhara, where they were obliged to remain three years. At last, meeting with some ambassadors from Hûlagû, the Mogul khan of Persia, to Kûbilaï, or Kûblaï (which see), the khagan or grand-khan of the Mongols, the brothers were induced to accompany them to Kemenfu, on the frontiers of China, the summer residence of the Mongol emperor. There they were favourably received by Kûbilaï, who eagerly questioned them regarding the rulers, peoples, forms of government, military tactics, and administration of justice of Europe. The reports of the two Polos incited the khan to send them, accompanied by one of his own nobles, on a mission to the pope, bearing missives requesting his holiness to send him 100 wise men skilled in the arts and sciences, and well versed in matters of religion, to instruct, and if possible convert, the Mongols to Christianity. In 1266 the brothers set out on their return journey, but had to leave behind them their companion, who fell ill by the way, and they arrived at Venice in 1269. They found the Papal chair vacant, and after waiting two years in vain for the election of a new pope, and finding it impossible to carry out the mission with which they had been intrusted, they set out for the East again, this time accompanied by the young Marco. They passed through Palestine, and in Armenia were overtaken by messengers from the newly elected pontiff, Gregory X., who brought them presents and letters for the khan. After a journey of three and a half years they reached the court of Kûbilaï, who received them with all the pomp and circumstance characteristic of an oriental potentate. Marco rapidly learned the language and customs of the Mongols, and became a special favourite of the khagan, who, on account of the noble port and powers of observation displayed by the young Venetian, employed him on various missions to several of the neighbouring princes. Marco conducted himself so well on these occasions,

and gave his master such vivid narrations of his experiences of the courts and peoples he had visited, that he soon rose to higher distinction. The northern provinces of China, Western Thibet, the city of Lassa, then the seat of an active commerce, and the province of Khorasan, were visited in succession by the young adventurer, who generally found the khan's favour a passport to the most secret and sacred places. He was also employed to assist in drawing up an inventory of the archives belonging to the court of the Song dynasty; and soon afterwards was made governor of the important city of Yang-tchou, in Eastern China, an appointment he held for three years. He accompanied a Mongol army in its advance upon the Kingdom of Pegu, and subsequently went on an embassy to Tsiampi, the modern province of Saïgon, in the south of Cochin-China, now in possession of the French. After passing seventeen years in the service of the khagan, the three Polos were commissioned to accompany the escort of Cogatra, a Mongolian princess travelling to Persia. They set out in 1292, travelled through China, and sailed through the Chinese Sea and Indian Ocean, experiencing numerous hardships on the voyage, and arrived at Teheran, where they remained for some time. Hearing that Kûbilai Khan had died in their absence, they resolved to return home, and reached Venice in 1295, loaded with wealth and jewels, but so altered in appearance, and speaking their mother tongue with such difficulty, that it was long before they could convince their friends of their identity. Marco Polo equipped a galley at his own expense and took part in the naval battle of Curzola in 1296, in which the Venetians under Dandolo were defeated by the Genoese under Doria, and during which Marco Polo was taken prisoner. During his captivity he dictated to a fellow-prisoner, Rusticiano of Pisa, with the aid of the memoranda he had taken during his journeys, an account of all his travels, which was finished in 1298. After his liberation he returned to Venice, where he was appointed a member of the grand council, which position he held until his death in 1323. His book created an immense sensation among the scholars of the time; many, however, did not hesitate to characterize it as pure fiction, and even on his death-bed the author was implored to retract his alleged falsehoods, but he solemnly reaffirmed all his statements. The reports of Catholic missionaries and of subsequent travellers confirmed great part of his narrative; and in the course of time the good faith, talent, and quickness and accuracy of observation of the great traveller began to be recognized. Polo seems to have been remarkably careful in his statements; what came under his own eyes and what he had on testimony are duly noted in his work. It has now been almost settled beyond doubt that his narrative was first written and published in French. It was published in Latin and Italian during Marco's lifetime. It made known to Europe the existence of many nations of which they were formerly totally ignorant, such as Japan (called by Polo Zipangu), &c.; created a passion for voyages of discovery, which resulted in the Portuguese finding a way to India by doubling the Cape of Good Hope, and in the discovery of the New World by Columbus, a close student of the book. It has gone through numerous editions in the various European languages; the best Italian edition is that entitled Il Milione di Messer Marco Polo Veneziano, edited by Count Baldelli (four vols. 4to, Florence, 1827). Recent and excellent editions have been edited by G. Pauthier (two vols. 8vo, Paris, 1865) and by Colonel Yule (The Book of Ser Marco Polo, the Venetian; two vols. London, 1871; 2d edition, 1875).

POLONAISE is a Polish national dance, which has been imitated, but with much variation, by other nations; also the tune to which it is danced. The *Polonaise*, in music, is a movement of three crotchets in a bar, characterized by a seeming irregularity of rhythm, produced by the syncopation of the last note in a bar with the first note of the bar following, in the upper part or melody, while the normal time is preserved in the bass. Movements of this sort, called by the Italians *Alla Polacca*, were once so popular that scarcely a single concerto was written without one being introduced into it.

POLOTZK (ancient *Peltiscum*), a town in Russia, in the government of Vitebsk, and 60 miles W.N.W. of the city of that name, situated on the right bank of the Dwina, and both banks of the Polotka. It has some fortifications of no great strength, particularly a castle somewhat dilapidated, which was built by Stephen Bathory, king of Poland, in the sixteenth century; and numerous churches and monasteries, but most of the houses are old and very indifferently built. The most remarkable edifices are the old Jesuit convent and college. It has some trade in flour and hemp, which is sent to Riga, and tanning is carried on to some extent. The town is one of the oldest in Russia, having been founded in the ninth century. A battle took place here between the Russians under Wittgenstein and the French under Oudinot in 1812, in which the latter were defeated. Pop. 12,201.

POLTAVA, or PULTAWA, a government of Russia, bounded on the north by Czernigov, on the east by Kharkov, on the south by Ekaterinoslav and Kherson, and on the west by Kiev; area, 19,265 square miles. It consists of an extensive and somewhat monotonous flat, highest in the north-east, and gradually declining to the south-west, where the Dnieper flows along its south frontier, and directly or by its tributaries the Sula, Piscol, Vorskla, and Orel, receives the drainage of all its surface. It is one of the most fertile and best cultivated portions of the Russian Empire, and exports about a fourth of its whole produce of wheat, oats, and barley. The meadows are both extensive and luxuriant, and the breeds of the immense herds of cattle and flocks of sheep which graze there are in general of a superior description. The rearing of bees is an important branch of rural economy. Both manufactures and trade are of very limited extent. The former are almost confined to woollens, leather, saltpetre, and brandy; the latter consists chiefly of agricultural produce, including horses and cattle, hemp, flax, tallow, wool, honey, and wax. Education, nominally under the superintendence of the University of Kharkov, is miserably neglected. Poltava is divided into fifteen districts. Pop. 2,445,423.

POLTAVA, or PULTAWA, a town of Russia, capital of the above government, on the Poltava, 445 miles S.S.W. of Moscow. It is walled, defended by a citadel crowning a small height, which rises up near its centre, and has spacious and regular streets; houses generally of wood, though some are of stone and brick. The trade, chiefly in cattle, corn, hemp, and wax, is very considerable; and the fairs, three in number, are very important. Under its walls in 1709 Peter the Great, at the head of the Russians, signally defeated the Swedes, under Charles XII. A monument in the principal square commemorates the victory; and 3 miles from the town is the tomb of those who fell in the battle, over which Peter set up a wooden cross, and which is still called the Swedish Tomb. Pop. 33,979.

POLYANDRIA, or POLYANDRY (from *polus* or *polys*, many, and *anēr*, a man) denotes the custom of one woman having several husbands at one time. This system appears to have its stronghold in Tibet, in the valleys of the Lower Himálayas, in the valleys of Cashmere, and farther south among the Coorgs of

Mysore and the Nayars of Malabar. In these regions a wife generally belongs to the brothers of one family, the elder brother being the chief husband and the reputed father of the progeny. The custom has been found prevailing on the north coast of Ceylon, among the New Zealanders (though there nearly obsolete), in several of the South Sea Islands, some parts of Africa, among the Saporogian Cossacks, and, according to Humboldt, among the tribes of the Orinoco. There can be little doubt but that this peculiar system originated in the disparity in numbers between the sexes caused by the practice of female infanticide common among wild warlike tribes, who look upon woman as an incumbrance rather than as a helpmate. Polyandria anciently existed in some parts of Media and among the Picts. See POLYGAMY.

POLYANTHUS, a variety of the common primrose (*Primula vulgaris*), a native of most parts of Europe, growing in woods and copses in a moist clayey soil. The leaves are obovate, oblong, toothed, rugose, and villous beneath. The umbel is radical, and flower-stalks of the length of the leaves. The tests of a fine polyanthus are, a strong, erect, and elastic stem; the tube of the corolla above the calyx should be short, well filled with the anthers, and should terminate fluted, rather above the eye or middle circle. This should be round, of a bright clear yellow, and distinct from the ground colour. The ground colour is most admired when shaded with a light and dark rich crimson, resembling velvet, with one stripe in the centre of each division of the limb, bold and distinct from the edging down to the eye, where it should terminate in a fine point. The pips should be large, quite flat and round, as much as is consistent with their peculiar figure, which is circular, with the exception of those small indentures between each division of the limb, marking it out into five or six heart-like segments. The edging should resemble a bright gold lace, bold, clear, distinct, nearly of the same colour as the eye and stripes. The polyanthus is propagated by dividing the roots, which are perennial, or by slips; and for procuring new varieties by sowing the seed of the approved sorts. The seed should be gathered about the last week of June, and in ten days afterwards sown in boxes in the open air with a northern exposure. In July the plants are to be placed in open beds, and must be sheltered from the sun and watered for some time. Some will show flowers the same autumn, and many in the following spring. They require to be transplanted every two years. The best soil is a light loam, with a considerable proportion of sand, a small quantity of rotten dung, and a little leaf mould or peat earth. The plants are very hardy, and seldom die even in the most ungenial seasons. In the heat of summer, however, they are liable to be destroyed by snails and slugs, and by a small red spider.

POLYBIUS, a Greek historian, was born at Megalopolis, in Arcadia, about 204 B.C. His father, Lycortas, was one of the leaders of the Achæan League, and the confidential friend of Philopœmen. Educated for arms and political life he was chosen, at the age of twenty-four years, as a member of an embassy to Ptolemy Epiphanes, but he did not leave Greece, as the embassy was abandoned. When the war between Perseus, king of Macedonia, and the Romans broke out, Polybius was sent to the Roman consul Marcius to inform him of the resolution of the Achæans to join him with their forces. He remained some time in the Roman camp, and then returned with a commission from Marcius to oppose the demand made by the commander Appius for more auxiliary troops to be sent to Epirus. About this time the design of the Romans to make all the free states of Greece dependent became evident, and Polybius took part in all the measures for the preservation of their independence. When, therefore, after the subjugation of Perseus, the Romans used less disguise, Polybius found himself among the 1000 hostages whom the Achæans were obliged to deliver up to the Romans. His learning, virtues, and talents soon gained him the favour of some of the most distinguished senators, especially Fabius and Scipio, the two sons of Paulus Æmilius. The hostages were not dismissed until seventeen years had elapsed, when Polybius, who did not wish to see again his degraded country, remained in Rome, and entered into the service of Scipio Æmilianus. He accompanied him on his expedition to Africa, and was a witness of the destruction of Carthage in 146. Directly after this he went to Greece, where the Achæans had become involved in a war with the Romans. He is said to have been present at the capture of Corinth by Mummius (146); but this is doubtful. On the defeat of the Achæans he used all his influence to mitigate the fate of his countrymen. Achaia was now converted into a Roman province. Amid these melancholy occurrences he preserved his patriotism and disinterestedness. He executed, to the satisfaction of both the Romans and Greeks, the difficult commission of introducing the new form of government in the cities of Greece. The people of Achaia erected statues to him, one of which had this inscription—'To the memory of Polybius, whose counsel, had it been followed, would have saved Achaia, and who consoled it in its adversity.' He is believed to have attended Scipio to Spain in 134, and to have been present at the siege of Numantia (133), but after the death of his great friend and benefactor, he returned to his native land, where he died in consequence of a fall from a horse, about B.C. 122.

Polybius is the author of a historical work from the beginning of the second Punic war (220) to the overthrow of Grecian independence (146 B.C.) It consisted of thirty-eight books, besides two introductory books, containing a sketch of the Roman history from the taking of Rome by the Gauls. Although the affairs of Rome are the chief subject, contemporary occurrences in other countries are also related, on which account Polybius gave it the title of a universal history (*historia katholikē*). We have of this great work only the first five books entire, and valuable fragments of the remaining books. Some of these fragments, as that containing an account of the Roman army, are of considerable length. The loss of the rest is very much to be regretted, as, in accuracy and fidelity of narration, and in extent of political and military knowledge, Polybius is surpassed by no historian of antiquity. To him is also attributed the introduction of didactic politics into history—that is, of that manner of writing history which, by intermingling views of the causes, occasions, and effects of events, is a useful introduction to politics. On the other hand, his style is destitute of beauty, and the narrative interrupted by lengthy digressions, which weaken the artistic effect. Livy was much indebted to Polybius after he came to the Second Punic war. Cicero mentions a particular work of his on the Numantian war. The most valuable editions of Polybius are those of Casaubon (Paris, 1609), of Jac. Gronovius (Amsterdam, 1670, three vols.), republished by J. A. Ernesti, with Casaubon's Latin translation and a commentary (1764), and those of Schweighäuser (Leipzig, 1789), Bekker (two vols. 1844), and L. Dindorf (two vols., Leipzig, 1866). The history of Polybius has been well translated into English by Hampton.

POLYCARP, according to tradition, a disciple of the apostle John, was born probably in Smyrna about the close of the reign of Nero. According to a legend-

ary fragment ascribed to a writer named Pionius, he was brought up by a noble Christian lady named Callisto, and was consecrated by St. John to the bishopric of his native city. When the controversy about the celebration of Easter began to run high he went to Rome to confer with Anicetus, who then occupied that see; and though he did not succeed in reconciling the differences between the Eastern and Western Churches, the questions were discussed in the most amicable manner. During the persecution under Marcus Aurelius he was seized and carried before the Roman proconsul at Smyrna. He was urged to revile Christ, but he replied, 'Eighty and six years have I served him, and he has done me nothing but good, and how could I revile my Lord and Saviour.' The people destined him to the wild beasts, but the judges condemned him to the flames. These, however, according to the legend, played harmlessly around him, in the shape of a swelling sail, and emitting a sweet fragrance. Seeing his body to be proof against the flames the judges ordered one of the executioners to run him through with a sword. A white pigeon suddenly flew up, and the flames were extinguished by the blood that flowed from the wound. This tradition, which probably contains some truth with a mixture of fable, has been turned to good account in one of the works of Herder. Polycarp is one of the saints in the calendar of the Roman Catholic Church, and the 26th of January has been consecrated to his memory. He wrote several letters, which were current in the early church, but have all perished except one addressed to the Philippians.

POLYCHROMY, a compound of two Greek words, signifying 'many colours,' is the name given to the art of decorating works of sculpture and architecture with different colours. The custom of painting statues is as ancient as sculpture itself; the Indians, Assyrians, Egyptians, Phœnicians, Babylonians, and Persians all painted their statues in various colours, especially in red, and further decorated them with plates of gold, silver, or ivory, besides adorning them with precious stones, and chains of gold and silver. But so far as we can judge from the rare specimens of the painted statues of those ancient peoples, polychromy had not reached the dignity of a real art; this it first attained only among the Greeks. From the remains of the tomb of Mausolus (see MAUSOLEUM) now to be seen in the British Museum it is to be inferred that a part of that monument was adorned with various colours; the statue of Mausolus was painted vermilion as well as the figures of personages on a bas-relief whose ground appears to have been painted blue. But it is open to question whether those figures may not have been painted long after the erection of the monument, at a relatively recent period, as the tomb was not destroyed entirely until the fifteenth century. In the National Museum at Naples a marble Apollo, which appears to be a Greek production, bears faint traces of colour, the hair being painted of a golden tinge, the pale blue drapery being adorned with a red band dotted with white flowerets. In the same museum may be seen a statuette representing the goddess Isis with the hair and a part of the drapery gilded. From an inscription found during the excavation, we learn that this statue had been placed in the temple of Isis at Pompeii by L. Cœcilius Phœbus by decree of the decurions. In the Glyptothek at Munich a statue of Leucothea has traces of gilding in the hair, and of red and green colour in the drapery. In the noblest epoch of Greek art polychrome sculpture underwent a complete change. Instead of employing colours the sculptors of the age of Pericles used marble of different colours fitted together, and the ornaments of those statues were made of various metals, and of ivory. Thus the nude parts of the figure were in some cases of Parian marble, the draperies of streaked onyx, the eyes of gold or ivory, the shields and other arms of bronze, and so forth.

Polychromy as applied in architecture may be divided into *natural polychromy*, which consists in the employment of materials producing certain effects by their natural colour; and *artificial polychromy*, which is simply the application of coats of paint to the various parts of the edifice, whether on the exterior or the interior. Both natural and artificial polychromy, the first having precedence in point of time, were used by the Assyrians, Babylonians, Persians, Egyptians, and, though this was a subject of doubt and even denial up till the beginning of the present century, by the Greeks. Plutarch in his Life of Themistocles informs us that one of the stelæ of the temple of Minerva in Eubœa was coloured saffron by means of a coating of which milk formed a constituent. We learn from Pliny that certain parts of the walls of the temple of Olympus were coloured with an analogous composition, and that for several centuries those walls retained their yellow tint. According to Pausanias the balustrade surrounding the Olympian Jupiter of Phidias was painted blue. The same author also tells us that several courts in Athens were painted, some green and others red. In some of the temples all the various parts of the buildings were detached by different tints, bringing out more clearly the effect of each member of architecture. Friezes, metopes, the bottoms of pediments, mouldings, cornices, &c., were covered with coats of fine plaster or stucco of various colours harmoniously combined, when the material was ordinary stone; when in marble the colours were applied without any medium. Pl. CLVIII. shows a group of objects illustrating polychromy as applied by the Greeks in sculpture and in architecture.

The Romans following the example of the Greeks cultivated polychromy, but in a much more restricted style. We find it employed in statuary in the bust of Antinous (now in the Louvre), which was formerly lightly coloured, and had eyes of precious stones inserted, like several sculptures of the same character found in Herculaneum and Pompeii. In the department of architectural polychromy we find in the last named [cities pillars and the inner and outer walls of buildings painted in various colours. (See Pl. CLX.) The pillar of Trajan at Rome was remarkable for the brilliancy and taste with which it was coloured. In the public and ornamental buildings of the later Romans gold decorations and facings of variegated stone appear to have been used instead of mere colours. In the middle ages polychrome architecture was adopted both by the Arabs and the Byzantines. In the tenth century gilded capitals and alternating variegated layers of stone again make their appearance. One of the finest examples of the Byzantine ecclesiastical architecture in the polychrome style is the Palatine Chapel at Palermo, erected by King Robert of Sicily in 1132, of the interior of which we give a view (Pl. CLIX.).

On the establishment of Gothic architecture polychromy was introduced into the interior of churches as one of the essential parts of a regular system. The foliage of capitals was gilded, the ground painted red, the ribs of arches and mouldings were decorated with gold and red or gold and blue, and even the plain surfaces of the arches were covered with a lighter tint of the same colours; altars, also balustrades, pulpits, sacramental tabernacles, &c., were painted on the ground and gilded on their projections. This practice maintained its place throughout the whole period of the middle ages, but in most churches sub-

sequent whitewashings have effaced all traces of it. In the period of the renaissance painting and gilding gradually ceased. The middle-age sculpture in wood and stone was at first, indeed, connected with painting, at least in statues not intended to stand in the open air. But the polychromy of the middle ages appears to have been entirely different from that of the Greeks, both in illusion and in reality. In the former not only were the draperies painted with the greatest and most varied splendour, but the hair and flesh were made to wear their true and natural colours, as may be seen in the famous statues of the Apostles in the choir of Cologne Cathedral. The broken light transmitted through painted windows tended, however, very much to diminish this effect, and is still one great obstacle to the progress of the taste for polychromy.

POLYCLETUS OF SICYON, one of the most celebrated of the Greek sculptors and architects. He was a pupil of the Argive statuary Ageladas, under whom Phidias at that time was also learning his art. He flourished about 452–412 B.C. As a sculptor he stood at the head of the schools of Argos and Sicyon, and is regarded as the most successful rival of Phidias, the head of the Athenian school. The latter was considered unsurpassed in his statues of the gods, and Polycletus in those of men. He excelled particularly in representing the graceful attitudes of the gymnastics of youth. One of his most celebrated statues was the Doryphorus (Spear-bearer), a youthful figure to which the name of *canon* or model was given, as in it the artist had given a perfect representation of the ideal of the human form. His statue of Hera (Juno), in the temple between Argos and Mycenæ, was thought by Strabo to be equal to Phidias's chryselephantine statues of Zeus and of Athena. The Olympian Queen was seated on a throne, crowned with a garland on which were wrought the Graces and the Hours; in one hand she held a pomegranate, and in the other a sceptre surmounted by a cuckoo. The head, breast, arms, and feet were of ivory, and the robe which covered the figure from the waist downwards was of gold. As an architect he distinguished himself specially by the theatre and rotunda at Epidaurus, which Pausanias pronounced to be the finest buildings of their kind ever erected by Greek or Roman artists. Polycletus also wrote a treatise on the proportions of the human form.

POLYCOTYLEDONOUS PLANTS, in botany, the term applied to those plants of which the embryos have more than two cotyledons or seed-lobes.

POLYCRATĒS, tyrant of Samos during the time of the elder Cyrus and Pythagoras. The Samians had till then been free, but with the assistance of his two brothers Pantagnotus and Syloson he made himself master of the island by violence, and endeavoured to secure supreme and sole power by every means, even by the death of one of his brothers and the banishment of the other. Having secured absolute sway, he proceeded to strengthen the city, enlisted 1000 archers, equipped 100 galleys, and seized upon several of the neighbouring islands, and even some towns on the mainland. He formed an intimate alliance with the Egyptian king Amasis. His extraordinary success in all his undertakings induced Amasis, as Herodotus says, to admonish him to avert greater calamities by some voluntary sacrifice. Polycratēs followed this advice, and cast his most valued jewel, a precious signet-ring, into the sea, which was, however, found a few days after in the maw of a fish that had been sent to him as a present on account of its remarkable size. This induced Amasis to renounce his alliance. When he was on the point of making himself lord of all Ionia and the neighbouring islands, the Persian satrap Oroetes, who considered himself injured by him, treacherously invited him to his palace, and crucified him (B.C. 522). Polycratēs seems to have had much taste for learning and the arts, and greatly promoted the refinement of the Samians. Anacreon, his favourite, and the celebrator of his fame, lived at his court.

POLYCYSTINA, the name originated by Ehrenberg, and applied to a family or group of Protozoa (which see) included in the order Radiolaria of that sub-kingdom. These organisms, all of microscopic or minute size, are allied to the better-known Foraminifera, which form huge fields of life in the depths of existing oceans, and which in past ages of the earth's history have been consolidated to form chalk-rocks. The shells of the Polycystina are, however, composed of siliceous or flinty material; those of the Foraminifera being formed of calcareous or limy matter. Through holes or apertures (*foramina*) in the siliceous shells, the sarcode-matter of which the primitive bodies of the Polycystina are composed, is protruded in the form of elongated ray-like processes or filaments named *pseudopodia*. The shell itself is frequently provided with spinous processes, and several of the shells of this group exhibit a remarkable regularity and mathematical beauty of outline and figure. Movements of granules or solid particles can be discovered taking place along the borders of the pseudopodia. The sarcode-matter of the bodies of Polycystina is of a brownish colour, and appears to contain yellow globules of various sizes. It does not generally fill the entire shell, but is limited to the upper portion of the structure, and exhibits also a division into four parts or lobes of equal size.

The Polycystina inhabit the sea-depths, and their shells mingle with those of Foraminifera and allied organisms to form the organic deposits which are continually being formed in the ocean-beds. Their distribution in *time* appears to have been of a more extensive nature than their present or geographical distribution. They are abundantly represented as fossil organisms, but are most familiarly represented in the deposit known as the 'infusorial earth' of Barbadoes, which belongs to the tertiary or recent period of geology. They also occur in rocks of mesozoic age, but are wholly wanting in the formations of the oldest or palæozoic period.

POLYDEUCĒS, or POLYDEUKĒS, the Greek name of Pollux. See CASTOR AND POLLUX.

POLYGAMY consists in a man's having more than one wife at the same time. It was common among the barbarous nations of antiquity, with the exception of the Germans, who, as Tacitus observes, 'prope soli barbarorum singulis uxoribus contenti sunt.' He says elsewhere, however, that their chiefs had the right of marrying several women at the same time. Among the ancient Britons there was a singular kind of polygamy. Any number of men joined in a society together, as was perhaps requisite for mutual defence. In order to link this society closer they took an equal number of wives in common, and whatever children were born were reputed to belong to all of them, and were accordingly provided for by the whole community. The ancient Medes compelled the citizens of one province to take each seven wives, and the women in another to have each five husbands, according as war had made extraordinary havoc in one quarter of their country among the men, or the women had been carried away by an enemy from another. Polygamy was also permitted among the ancient Greeks when necessity seemed to require it, as in the case of the detachment of young men from the army of Lacedæmon, mentioned by Plutarch. It was also allowed among the Etruscans (12 Athen. 3). It was also defended by

Euripides and by Plato, whose doctrine was rather a community of wives than a plurality. The ancient Romans never practised polygamy, though it was not forbidden among them; and Mark Antony is mentioned as the first who took the liberty of having two wives. From that time it became frequent in the Roman Empire till the reigns of Theodosius, Honorius, and Arcadius, who prohibited it A.D. 393. After this Valentinian permitted all his subjects to marry several wives if they pleased; nor does it appear from the ecclesiastical history of the times that the bishops made any opposition to the introduction of polygamy. Pope Gregory II., in a decretal dated 726, allows a man to marry a second wife 'if the first is infirm and incapable of conjugal functions.' We learn from Gregory of Tours that the Merovingian kings had several wives, and that Charlemagne had a great number. Luther looked upon marriage as a civil contract and not a sacrament, and permitted the Landgrave of Hesse to take a second wife during the lifetime of the first.

Polygamy prevailed among the Jewish patriarchs both before and under the Mosaic law. But the state of manners had probably become reformed in this respect before the time of Christ, for in the New Testament we meet no trace of its practice. In the Christian code there is no express law upon the subject. The words of Christ, however, in Mat. xix. 9 may be construed by an easy implication to prohibit polygamy, for if 'whoever putteth away his wife and marrieth another committeth adultery,' he who marrieth another without putting away the first is no less guilty of adultery, because the adultery does not consist in the repudiation of the first wife, but in entering into a second marriage during the legal existence of the first. The passages in St. Paul's writings which speak of marriage always suppose it to signify the union of one man with one woman. But however this may be, polygamy has been as entirely disused and universally prohibited in all Christian countries as if Christianity had expressly forbidden it. Polygamy has been allowed under all the religions which have prevailed in Asia. By the laws of Mohammed every Mussulman is permitted to have a plurality of wives. The Arabs, however, seldom avail themselves of this privilege, and the practice is becoming gradually rarer in Turkey, Egypt, and all those countries that are brought much into communication with western civilization. Although forbidden by the Congress of the United States in 1870, it is still practised to a considerable extent among the Mormonites in the territory of Utah.

In England, originally, the offence of polygamy was considered as of ecclesiastical cognizance only, and although a statute of Edward I. treated it as a capital crime, it appears still to have been of doubtful temporal cognizance until the statute of James I. cap. xi., enacted that persons guilty of polygamy should suffer death, as in cases of felony; but the benefit of clergy was not thereby taken away. By the statute 9 Geo. IV. cap. xxxi. s. 22 polygamy is punishable with transportation for seven years, or imprisonment. In the United States of America the punishment is generally imprisonment for a longer or shorter period, fine, &c. By a constitution of Charles V. it was a capital crime, and by the laws of ancient and modern Sweden it is punished with death. By the Prussian code of 1794 polygamy is punishable by confinement in a house of correction or fort for at least one and not more than two years.

The practice of polygamy has been defended by several authors in modern times. Montesquieu affirms that it is physically conformable to the climate of Asia. He has also suggested that the irregularity in the comparative number of each sex born in Asia, which is represented to be greatly superior on the part of the female side, is also an argument in favour of this practice; but there is good reason for denying the reality of this supposed inequality. In the year 1780 the Rev. Mr. Madan published his Thelypthora, in which he attempted to vindicate polygamy, and proposed the introduction of licensed polygamy in case of female seduction as a remedy for prostitution. He was ably answered by a writer in the Monthly Review, vol. lxiii. p. 328.

POLYGLOT (Greek, *polus* or *polys*, many, and *glotta*, language), a work which contains the same matter in several languages. It is more particularly used to denote a copy of the Holy Scriptures in which two, three, or more translations are given, with or without the original. Polyglots are of great service for understanding the Scriptures, and were early undertaken by theologians. The first great work of the sort is the Complutensian polyglot, prepared by several learned men, under the patronage of Cardinal Ximenes. Great care and pains were taken in procuring early manuscripts of the text and of the translations. It was splendidly printed (1514–17), in six folio volumes, at Alcala de Henares, called in Latin *Complutum*, whence the name of the work. It contains the Hebrew text of the Old Testament, with the Vulgate, the Septuagint, a literal Latin translation, a Chaldee paraphrase (which is also accompanied by a Latin translation). Another celebrated polyglot is that of Antwerp, called the *Royal Bible*, because Philip II. of Spain bore part of the cost of publication. It was conducted by the learned Spanish theologian Benedict Arias Montanus, who was assisted by other scholars. It appeared at Antwerp in eight folio volumes (1569–72), and, besides the Hebrew text, contains the Latin Vulgate, the Septuagint (with a literal Latin translation), several Chaldaic paraphrases (Targums), also accompanied by a Latin translation, and the New Testament in the original Greek, with the Latin Vulgate, and a Syriac translation in Hebrew and Syriac letters (also with a Latin translation). Still more celebrated is the Paris polyglot, executed principally under the direction of Gui Michel le Jay (an advocate to the parliament, who expended his whole fortune on the object), by several distinguished orientalists and critics. It appeared in 1645, in ten folio volumes, and contains, in addition to the contents of the Antwerp polyglot, a Syriac and an Arabic translation (with Latin), and also the Samaritan Pentateuch (a Samaritan text, with a translation), and likewise an Arabic translation of the New Testament, with a Latin translation of the same. The London or Walton's polyglot, in ten languages, appeared in six volumes folio, with two supplementary volumes (London, 1654–57). It was conducted under the care of Bryan Walton, afterwards Bishop of Chester, and contains all that is in the Paris polyglot, but with many additions and improvements. It contains the original text according to several copies, with an Ethiopic and a Persian translation, and the Latin versions of each. Cromwell patronized the undertaking. Bagster's Polyglot (folio, London, 1831) gives eight versions of the Old Testament and nine of the New.

POLYGNOTUS, one of the most distinguished Greek painters, flourished from 450 to 410 B.C. He was a native of the Island of Thasos, and along with his brother Aristophon was instructed in their art by their father Aglaophon. Cimon, the commander, and rival of Pericles, brought him to Athens on the subjugation of Thasos, and employed him to decorate the Pœcilē, or painted portico at Athens. He was the favoured lover of the beautiful Elpinice, sister of Cimon. Micon and Panænus assisted him

in painting the Pœcilē. His two principal pictures there represented the Greeks before Troy; the subject of one of them was the assembly of the chiefs after the rape of Cassandra; of the other the captive Trojan females, in the midst of whom was Cassandra. In the Leschē (hall) at Delphi he painted the Conquest of Troy and the Regions of the Dead, which are described by Pausanias. In a portico of the Parthenon there were also several easel-pieces relating to the Trojan war. In the temple of Castor and Pollux was a painting representing the abduction and marriage of the daughters of Leucippus, and in the propylæa were several pictures. His works were probably on wood. Polygnotus is represented as being the first who made painting independent of sculpture, and gave life, motion, character, and expression (whence his surname *ethographos*) to the countenance, skilful disposition to the drapery, and proportion to the figures, and he is said to have been the first who painted *tetrachromes* (pictures with four colours). With him began the grand and lofty style in Greek painting.

POLYGONACEÆ, or POLYGONEÆ, a natural order of herbaceous, rarely shrubby, plants, with alternate, stipulate or exstipulate leaves, and often unisexual flowers. The perianth is inferior, divided, and not unfrequently coloured; three to nine stamens inserted into the bottom of the perianth; ovary free, usually formed by three carpels, unilocular, and containing one ovule; styles and stigmas equal to the carpels in number. The fruit is generally a nut, often triangular; seed erect; albumen farinaceous. Some species produce a succulent, edible fruit. There are twenty-nine well-known genera, including about 500 species. They are found in all quarters of the globe, but more especially within the north temperate zone. They have astringent and acid properties; some are purgative, and a few are acrid. The root of Bistort (*Polygonum Bistorta*) contains much tannin, some gallic acid and starch, and is a powerful astringent. The leaves of *P. hydropiper*, often called Water Pepper, a plant common by the sides of lakes and ditches in this country, are acrid enough to be used as a vesicant. From *P. tinctorium*, a native of China, a blue dye, scarcely inferior to indigo, is obtained. The fruit of *P. aviculare*, commonly known as Knot-grass, a common weed in all parts of the world, is emetic and purgative. The fruit of *Fagopyrum esculentum* and other species of buckwheat is used as food. (See BUCKWHEAT.) The leaves of *Rumex acetosa*, or Common Sorrel, and of *R. acetosella*, or Field Sorrel, are acid and astringent; and the roots of *R. aquaticus*, or Water Dock, and of other species, are used as astringents and alteratives, while those of *R. alpinus*, under the name of Monk's Rhubarb, were formerly used as purgatives. One of the most important plants of this order is the Rhubarb plant. (See RHUBARB.) The *Coccoloba uvifera*, or Sea-side Grape of the West Indies, yields an astringent substance known as kino.

POLYGON OF FORCES, a dynamical principle founded on the parallelogram of forces, and said to have been discovered by Leibnitz. See MECHANICS.

POLYHYMNIA, or POLYMNIA, according to the later Greek poets the muse of lyric song and of eloquence, to whom is attributed the invention of the lyre and of mimes and pantomimes. The Grecian artists represented her enveloped in a mantle, crowned with a wreath of flowers, and in a meditating posture. Her attributes are the lyre and the plectrum. She places the forefinger of her right hand on her mouth, or holds a scroll.

POLYMERISM is a particular instance of isomerism (which see). *Polymerization* is a name given to the process by which a chemical compound is transformed into another having the same per centage composition but a different molecular weight; thus the hydrocarbon anylene, C_5H_{10}, when acted on by strong sulphuric acid, is converted into the polymer paramylene, $C_{10}H_{20}$.

POLYMORPHISM, the property possessed by certain bodies of crystallizing in two or more forms not derivable one from the other. Thus mercuric iodide separates from solution in tables belonging to the dimetric system; if these crystals are heated they sublime and condense in forms belonging to the monoclinic system; carbonate of calcium exists as calc-spar, which crystallizes in rhombohedral forms, and as arragonite, which crystallizes in trimetric forms.

POLYNESIA (Greek, *polus* or *polys*, many, and *nēsos*, island), the name given by geographers to the numerous islands scattered over the Pacific Ocean, extending from about lat. 35° N. to 50° S., and from lon. 135° E. to 90° W. The islands are distributed into numerous groups; these groups have an elongated form, with a general direction from north-west to south-east, and are composed of one or more larger islands and many smaller ones. The groups north of the equator are the Pelew Islands, the Ladrone or Marianne Islands, the Caroline Islands, the Radack and Ralick groups, the Sandwich Islands, Gilbert's or Kingsmill's Archipelago, and the Galapagos. South of the equator are New Ireland, New Hebrides, New Britain, Fiji Islands, Navigator Islands, Friendly Islands, Cook's or Harvey Islands, the Society Islands, the Dangerous Archipelago, the Marquesas or Mendaña Islands, and the isolated Pitcairn, Ducie's, and Easter Islands. With the exception of Hawaii, the largest island of Polynesia, the most considerable of them range from 20 to 60 and 100 miles in circumference, while many do not exceed 1 or 2 miles in length. Some of these islands are volcanic and some of them coralline in their origin. The volcanic, or, as they are called, the high islands, rise to a considerable height above the level of the ocean; they are of basaltic and other igneous formations. The principal groups of these are the Friendly Islands, one of which, Tahiti, has a mountain 10,000 feet above sea-level; the Sandwich Islands, on the largest of which, Hawaii, are several extinct and active craters, some of them reaching the height of 13,000 to 16,000 feet; the Marquesas Islands, Navigator Islands, and the Galapagos Archipelago. The coral or low islands comprise the Carolines and the Dangerous Archipelago, where examples of the atoll form are to be found; the Society Islands, the Gambier Islands, and numerous other groups, where barrier reefs occur. The elevations of these groups do not exceed 500 feet. (See CORAL.) The temperature of Polynesia, owing to the great predominance of ocean, is comparatively moderate, and the climate is delightful and salubrious; the mean annual temperature of the Sandwich Islands is 77° Fah., of the Society Islands 70° to 80°, rarely 90°. The south-east tropical wind generally prevails, but north-west and south-west winds are not uncommon. Thunderstorms and waterspouts are common; hurricanes are rare, and earthquakes slight and unfrequent. The soil in the valleys and river courses is very fertile. The bread-fruit, the cocoa, banana, plantain, banyan, sugar-cane, yam, cotton plant, paper mulberry, and a species of chestnut are indigenous. The orange, lemon, melon, potato, and other fruits and plants have been successfully introduced. Hogs, dogs, and rats were the only quadrupeds found on the islands when first visited; but oxen, horses, sheep, and pigs have now been introduced into some of the more important groups. Snakes and other reptiles are confined to the Navigator Islands. Land birds are not numerous, pigeons,

paroquets, owls, and sparrows being the principal; wild ducks and other water-fowl are more abundant. Turtles are found in great numbers in various localities, and fish are plentiful on the coasts. Several species of whales, as the sperm whale, the Cape whale, the humpback, &c., are peculiar to these waters.

The Polynesians are in general a well-formed, tall, active, and intelligent people. They consist of two or three different races, the most predominant being apparently of Malay origin, who occupy the central and eastern portion of Polynesia. They have oval faces, often aquiline noses, nostrils wide—a characteristic often increased by artificial means; the ears are largish; there is great variety of hair and complexion. Their language, which is said to be allied to the Tagala of the Philippines, is split up into numerous dialects, all to a great extent intelligible to the inhabitants of the same race scattered over the various groups. The other principal race seems to be of negro or Papuan origin; they have negro features and colour, and crisped, mop-like hair. These were probably the first settlers of the islands. They are confined to the western parts of Polynesia, and speak a different language, the numerous dialects of which differ widely from each other. They are not so tall as the first-mentioned race, and are decidedly inferior in intelligence. In some of the islands there is a partial intermixture of the two races, and in others an apparent Caucasian intermixture, indicated by the ample beard and prominence of the features. Paganism, originally the prevalent religion of all the Polynesians, has begun to disappear through the labours of English and American missionaries. Cannibalism, infanticide, tattooing, circumcision, the use of the intoxicant kawa, the institution of the taboo (or tabu), are rapidly losing ground through the influence of Christianity and a higher civilization. The population varies continually from wars, migrations, occasional pestilence, and, it must be added, from the vices and diseases communicated by Europeans and Americans. Some of the western islands, as the Ladrones, were discovered by Magellan as early as 1521, the Marquesas by Mendaña in 1595, but it was not until 1767 that Wallis, and subsequently Cook, explored and described the chief islands of this region. For further information see articles on the individual groups and islands.

POLYNICES. See ETEOCLES and THEBES.

POLYPE, POLYPI, &c. The term 'Polype' has been very variously and indiscriminately applied to different animal forms. It has thus been used to designate any animal of low organization, such as the sea-anemones, corals, and their allies; or it has been employed to indicate animals, which, like the Cœlenterate Zoophytes or Hydrozoa, and the Molluscan Polyzoa, bear a close resemblance to plants. Whilst it has been also popularly applied to such forms as the Cuttle-fishes, though in this latter case the nearly-related term 'poulpe' has supplanted the use of the more general polype. The most obvious disadvantage of the term when used in zoology, and as frequently employed in the older works, is that it has been used to include in one group animals of a widely dissimilar nature, and which frequently possess no true or structural relationship whatever. The applications of the term 'Polype' and allied names have, however, been greatly altered and improved for the better in the modern terminology of natural history. At present the term *Polype* is limited to denote any single member of the class Actinozoa, represented by the Sea Anemones, Corals, and the like; or any member (or zoöid) of a compound organism belonging to that class. The term *Polypide* is now employed to designate each member or zoöid of the compound forms included in the Molluscan class Polyzoa or Bryozoa, represented by the Sea-mats (*Flustra*), &c. The name *Polypidom* applies to the entire outer framework or skin-system of a compound form such as a Hydrozoan Zoophyte or a Molluscous Polyzoön. The word *Polypite* refers to each separate zoöid or member of a compound Zoophyte or Hydrozoön, and is thus used in opposition to the term *polypide* already explained. The *polypary* of a Hydrozoön specially refers to the horny or chitinous skin secreted by the Hydrozoa. See also CŒLENTERATA, HYDROZOA, MOLLUSCA, POLYZOA, &c.

POLYPHEMUS, son of Poseidōn, the most famous of the Sicilian Cyclopes, is described as a giant living by himself in a cave in Mount Ætna and feeding his flocks on that mountain. Ulysses and his companions having been driven upon the shore by a storm, and having unwarily taken refuge in his cave, were found there by Polyphemus when he returned home at night and shut up the mouth of the cavern with a large stone. Having seized two of the strangers he ate them for supper, and the next morning made a breakfast of two more of them, after which he drove out his flocks to pasture, and shut up the unhappy captives by closing the entrance of his cave. Ulysses then contrived a plan for their escape. He intoxicated the monster with wine, and as soon as he fell asleep bored out his one eye with the blazing end of a stake. He then tied himself and his companions under the bellies of the sheep, in which manner they passed safely out in the morning. Polyphemus was the lover of the nymph Galatea, but the nymph despised his offers, and preferred Acis, who was killed by his jealous rival. See GALATEA.

POLYPHONIC, a term applied to a musical composition in two or more parts, each of which forms an independent theme, progressing simultaneously according to the laws of counterpoint, as in a fugue, which is the best example of polyphonic compositions. (See COUNTERPOINT—Example IV.) Compositions consisting of a leading melody, with subsidiary parts added to strengthen it, are called homophonic.

POLYPTERUS, a genus of fishes inhabiting the Nile, Senegal, and other rivers of Africa, and included in the Ganoid order of the class. They form types of a special family, the Polypteridæ, and belong to the group of Ganoid fishes known as the Crossopterygidæ—that is, those in which the pectoral, and generally the ventral fins also, consist of a central piece or disc formed by the skeleton of the limb, and covered with scales. To this disc the fin-rays are attached. The scales are ganoid, and are of solid enamelled texture, and of rhomboidal shape. They overlap each other; and are, in addition, articulated by means of processes which spring from the one set of scales and fit into depressions in neighbouring scales. The body is cylindrical, and of elongated form. The head is somewhat flattened. A pair of openings termed *spiracles* exist on the top of the head, through which water may be conveyed to the gills. The spiracles may be closed at will by valvular structures. The pectoral fins are of rounded shape. The ventral fins are situated far back on the body. A single anal fin exists; but the dorsal fin is remarkable as being broken up or divided into numerous detached portions, each consisting of a front spine with a soft fin attached to its hinder margin. No 'fulcra' or pointed bony plates exist on the margins of the fins in Polypterus. The caudal or tail fin is heterocercal, but is not markedly asymmetrical in the disposition of its lobes. The bodies of the vertebra are fully ossified, and are amphicœlous in form—that is, concave both in front and behind. No branchiostegal rays exist in these fishes. The

air-bladder is of double conformation, and sacculated or cellular, whilst it communicates with the gullet by a tube—the 'pneumatic duct.' This disposition of parts renders the air-bladder somewhat lung-like in appearance and homology. The united ureters open into the cavity of the united oviducts in Polypterus, instead of the oviducts opening into the ureters as in other Ganoid fishes. The Polypteri, from the complete investment of their bodies in ganoid scales, are included in the Lepidoganoid group of their order. The familiar species of the Nile (*Polypterus bichir*, Pl. CL–CII.) possesses sixteen divisions in the multifid dorsal fin. *P. Senegalensis* of the Senegal River has twelve similar divisions. The former attains an average length of about 18 inches. It appears to inhabit the muddy bottom of the river. Its flesh is esteemed good for the table. The Polypteri are unknown as fossil organisms.

It may lastly be remarked that the young of Polypteri have recently been stated to possess outside or external gills in the young state, and to lose these on attaining the adult state. In the curious Lepidosirens or Mud-fishes (see DIPNOI) external branchiæ are known to be occasionally developed; and if these organs be present in Polypteri, the fact will show them to be allied to the Lepidosirens, and through these latter to the amphibian Vertebrata (Frogs, Newts, &c.), all of which possess external gills in early life.

POLYPUS, in medicine, a name given to swellings which form chiefly in the mucous membranes, and were considered to resemble the animal of the same name. These tumours are most common in the nostrils, the throat, the uterus, and are more rarely found in the stomach, the intestines, the bladder, or the external passage of the ear. Polypuses differ much in size, number, mode of adhesion, and nature. One species is called *mucous*, *soft*, or *vesicular* polypuses, because their substance is soft, spongy, vesicular, and as it were filled with white juices; another is called the *hard* polypus, and has been distinguished into the fibrous or fleshy and the scirrhous or cancerous. The fibrous polypuses are of a dense, close texture, and of a whitish colour; they contain few vessels, and do not degenerate into cancers. The scirrhous or carcinomatous polypuses are really cancerous, painful tumours which discharge blood and exhibit all the pathological changes of cancerous affections. Different modes of treatment must be adopted, according to the particular nature of the disease. Among the methods of cure are *exsiccation*, which consists in subjecting the polypus to the action of astringent powders or solutions to effect the resolution of the tumour; *cauterization*, or the application of fire and caustics; *excision*, or the removal of the polypus by the knife; *extraction*, or its removal by the fingers or by pincers; the *seton*, which consists in the application of a wire or thread for the purpose of destroying the pedicle; by *ligature*, which consists in tying up the base of the tumour, and causing it to fall off by the destruction of the vascular pedicle which nourishes it; or by the *écraseur*, which is now most frequently adopted.

POLYSYNDETON (the opposite of *asyndeton*) is the name given to a figure of speech by which the conjunctive particles of sentences are accumulated, contrary to usual custom, either for the purpose of giving a greater emphasis to the terms connected by them, as when Schiller says, 'And it waves and boils, and roars and hisses:' or more distinctly to mark the gradual transition from one circumstance or subject to another; or to retard the too rapid progress of objects presented; or to render the connection between different sentences, or different parts of the same sentence, more visible and distinct.

POLYTECHNIC SCHOOL. See ÉCOLE POLYTECHNIQUE.

POLYTHEISM (Greek, *polus* or *polys*, many, and *theos*, god), the belief in, and worship of a plurality of gods; opposed to monotheism, the belief in, and worship of one God. It is still a matter of debate whether polytheism is a primary form of human belief, or a degeneration of an original monotheistic idea. It is argued, on the one hand, that the sense of personal dependence into which most philosophers have agreed in resolving the earliest elements of natural religious feeling, could not, in the first instance, lead man to a notion of a plurality of gods. The undefined power which he feels to be around and above him, the mysterious *something* which is independent of him and which is stronger than he, did not primarily present itself to his mind except under a form of unity. His earliest religion would therefore be of a monotheistic character, but of a highly unstable nature, and eminently liable, amongst races of rude faculties and little power of abstraction, to assume a polytheistic form. It was far from attaining the level of a dogmatic monotheism, a religion which not only possesses the conception of God as one, but a conception the negation of the existence of more gods than one—a negation which is only possible after the conception of more gods than one. The lapse from the monotheistic idea may be explained in two ways, according as we may suppose it to have arisen from infirmity of thought or deficiency of language. According to the former theory the lapse would be the result of the dominion exercised at all times, but most of all in a rude age, of the senses over the reflective faculty. The idea of one Supreme Being would be always liable to be obscured by the multiplicity of the visible operations of that being on earth. The tiller of the soil, in simple times, waiting anxiously for the sun or rain, would, on his joy at their arrival or despair at their approach, be prone to attribute his good or ill fortune to some individual power for whose benefits he must be grateful, or whose wrath he must propitiate; and a worship containing the elements of prayer and thanksgiving would soon spring up between man and those supposed powers who governed the earthly phenomena. It is held by those who ascribe the corruption of the monotheistic idea to a deficiency of language that the inability of mankind either to ascend to the conception of an abstract being, or, in a rude age, to adapt language to such a conception, prevented man from giving the Unseen Being a name connoting that existence which they were conscious of as one; and they were therefore compelled to designate him by names connoting those acts and attributes which they were conscious of as many.

We come now to give a brief statement of the arguments of those who affirm that polytheism was a primary form of religious belief. Ignorant of the nature of his own life, and of the nature, origin, and properties of other objects, man at first could only attribute vaguely to all visible things the same kind of existence as that which belonged to himself. This existence involved simply the notion of consciousness, for the distinction between consciousness and personality was of later growth. Thus the sun, moon, and stars would all be living beings; and their influence, from the absence of any idea of a natural order, would be seen in the working of the material world, and in all the accidents of human life. Their actions would appear beneficent or malign; and hence these beings would be invested each with a special character. As being beyond human control, and as affecting the condition of men, they would be loved or feared; and with the growth of the idea that they might be propitiated or appeased the system of poly-

theism would be complete. See MONOTHEISM and MYTHOLOGY.

POLYZOA (Greek, *polus*, many; *zoön*, animal), a class of Molluscoida or Lower Mollusca (see MOLLUSCA), sometimes also known by the name of Bryozoa (Greek, *bruon*, moss, and *zoön*). The former name has been applied to this group in allusion to the invariably *compound* nature of its included forms, whilst the latter name was given from the plant or moss-like appearance presented by many members of the class. The class Polyzoa may be defined as comprising Molluscoida, which always form *compound* colonies. The body consists of an alimentary tract, contained within a sac or cell, with double walls. The upper part of the alimentary tract may be protruded from or withdrawn into the sac, that is, may be evaginated or invaginated. The mouth is surrounded by a circle of hollow tentacles provided with cilia. No heart exists in this class. The Flustræ or Sea-mats, so frequently cast up on our shores, and which resemble pieces of pale brown sea-weed, exemplify familiar members of the group. When the sea-mat organism is examined the seaweed-like structure is seen to be composed of numerous little closely-set cells, in each of which a little animal was contained. The entire structure is known as a *polyzoarium*, and the individual *zoöids*, or forms, which by their aggregation make up the colony, are known as *polypides*. The compound mass is produced from a single primitive polypide by a process of gemmation or continuous budding. Each cell and its tenant is the counterpart of its neighbours. There is an outer coriaceous or calcareous cell-wall, the *ectocyst*, and an inner, soft, contractile wall, the *endocyst*. The ectocyst forms the connecting medium by means of which the different cells are bound together. On the ectocyst certain peculiar processes named *avicularia* (or 'bird's head processes') and *vibracula* are found. These structures exhibit independent movements, and their functions are wholly undetermined. The mouth opening at the upper part of each cell is surrounded by a circlet of hollow ciliated tentacles, on which devolves the function of respiration. A gullet, stomach, and intestine are suspended within the cell, amid the clear fluid (*perigastric fluid*) which fills the interior. This fluid undergoes a circulation in each cell through the movements of the vibratile cilia or delicate hair-like filaments which line the endocyst. The anal opening is situated in close proximity to the mouth, and between the mouth and anus the single nervous ganglion is situated. A 'colonial nervous system' (Müller) is supposed also to exist, by means of which the various members of the colony are brought into relation with each other. The tentacles are borne upon a stage or *lophophore*, which in the majority of marine Polyzoa is circular in shape, but in most of the fresh-water forms is horse-shoe shaped or crescentic in form (*Hippocrepian Polyzoa*). In the Hippocrepian forms a valvular lid termed the *epistome* exists, this structure overhanging the aperture of the mouth. The tentacles and upper part of the digestive tract can be invaginated, that is, may be withdrawn into the cell after the fashion of a glove finger thrust in upon itself. The muscular system of these forms is highly developed; the muscles (retractors) which retract the animal within the cell being especially developed. The evagination or protrusion of the tentacles appears to be effected by circular fibres which are disposed around the cell, and particularly around the oral opening. A gizzard is described as being present in some Polyzoa; and the functions of a liver have been ascribed to certain cells in the neighbourhood of the stomach. The reproductive organs consist of ovary and testes; male and female elements being thus contained within each cell of the colony. These give origin to fertilized ova or eggs, which escape from the cells, and develop each a single primitive polypide or cell; and this latter by a process of budding produces the compound colony of the Polyzoön. Each colony has thus of itself an unlimited power of increase by budding, and also the power of giving origin to new colonies through eggs produced by a truly sexual process. The *winter-ova* or *statoblasts* of Polyzoa are peculiar bodies consisting of germinal matter inclosed between two horny discs like watch-glasses placed face to face, and united by a ring running round the edge of the discs. These statoblasts are produced by a process of budding on a cord-like structure which is attached to the stomach, and which is termed the *funiculus*. They are liberated from the parent body generally after its disintegration. When thus set free the discs of the statoblast separate, and a primitive polypide escapes, which soon attaches itself and develops all the features of the individual from which it sprung. These bodies are regarded by Allman as being peculiar buds or *gemmæ*, which are destined to survive the cold of winter, and which thus lie in a dormant or quiescent state prior to undergoing development. No sexual process is concerned in the production of statoblasts, and therefore they are not to be regarded as in any way corresponding to true ova.

The class Polyzoa is divided into two orders. The *Phylactolæmata* possess a crescentic lophophore and an epistome. The *Gymnolæmata* or Infundibulata possess a circular lophophore and want the epistome. The Gymnolæmata are represented by marine Polyzoa exclusively, with the exception of a single family, that of the Paludicellea, represented by the *Paludicella articulata* (a species occurring in certain Irish loughs), and by *Urnatella*. The other chief divisions of this group are, firstly, the Cyclostomata, represented by the genera *Tubulipora*, *Diastopora*, *Crisia*, &c., in all of which the cells are tubular, and the cell-opening terminal in position and of the same diameter as the cell; whilst the outer portion of the cells is generally calcareous. The Cheilostomata possess less completely rectractile polypides, the orifices of the cells being subterminal, the cells not tubular, and of fleshy, horny, or limy consistence. The genera *Salicornaria*, *Cellularia*, *Scrupocellaria*, *Scrupuria*, *Gemellaria*, *Bicellaria*, *Flustra*, *Carbasea*, *Membranipora*, *Lepralia*, *Cellepora*, *Eschara*, &c., are included in this latter division. The Ctenostomata, in which the orifices of the cells are terminal and provided with fringe-like structures for their closure, form the last group of the Gymnolæmata. The cells in this division are distinct, and originate from a common tube. The genera *Alcyonidium*, *Sarcochitum*, *Vesicularia*, *Valkeria*, *Bowerbankia*, &c., represent the Ctenostomata.

The Phylactolæmatous Polyzoa include the fresh-water sub-order Lophopea, the marine Rhabdopleurea, and the marine Pedicellinea. The genus *Lophophus* represents the first sub-order; and other prominent fresh-water genera are *Cristatella* and *Plumatella*.

POMACEÆ, a natural order of plants, according to some botanists, but generally considered as a division of the natural order Rosaceæ. It differs from Rosaceæ proper in having the tube of the calyx more or less globose, the ovary fleshy and juicy, lined with a thin disc, in the adhesion of the carpels with the sides of the calyx, and more or less with each other. The fruit is always a *pome*, that is, it is made up of a fleshy calyx adhering to fleshy or bony ovaries containing a definite number of seeds. The plants belonging to this order or sub-order are peculiarly distinguished by their ovules being in pairs and collateral; while rosaceous plants, when they have two or more ascending ovules, always have them placed

one above the other. There are about 200 species found plentifully in the temperate and colder regions of the northern hemisphere; they may be said to be entirely absent from the southern hemisphere. The order, which consists exclusively of trees and shrubs, produces a number of the finest fruits of temperate climates, as the apple, pear, quince, medlar, &c.

POMADE, POMMADE, or POMATUM (Latin, *pomum*, apple), a term originally applied to a fragrant ointment prepared with lard and apples, but now wholly restricted to perfumed solid greasy substances used in dressing the hair. In the preparation of pomades the first object of consideration is to obtain their fatty basis in as pure and fresh a state as possible. Lard, beef and mutton suet, beef marrow, veal fat, and bear's grease are the materials commonly employed for this purpose, either singly or in mixtures of two or more of them. The fat, which should be that of a young and healthy animal, is pounded in a marble mortar in the cold, until all the membranes are completely torn asunder; it is then submitted to the heat of a steam-bath until its fatty portion has liquefied, and the albuminous and aqueous matter and other foreign substances have completely subsided. The liquid fat is then carefully skimmed and passed through a flannel filter. In this state it may be perfumed at will; after which, when it is intended that the pomade should be white, it must be constantly stirred with a glass or wooden spatula until it solidifies; should it be wished transparent or crystalline it is allowed to cool very slowly without being disturbed. To prevent its becoming rancid a little benzoic acid, gum benzoin, or nitric ether may be added, and to increase its consistency a little wax or spermaceti. Pomade may be perfumed by enfleurage, maceration, or simply by adding the fragrant essences or essential oils in the required quantity. See PERFUMERY.

POMBAL, SEBASTIÃO JOSÉ CARVALHO, Count of Oeyras, Marquis of, a celebrated Portuguese statesman, was born in 1699 at the castle of Soura, near Coïmbra, and died in 1782. His father was a captain of artillery, and belonged to the lower class of the nobility; and the son, after having studied law at Coïmbra, served also for some time in the army. Nature had given him all the qualities which indicate a person destined for rule; a tall and strong frame, a vigorous constitution, strong passions, a penetrating judgment, and the most captivating address. Having been banished from Lisbon on account of some youthful imprudences, he passed several years at Soura devoted to study. While there he married Teresa de Noronha Almada, a rich widow, and subsequently returned to court, where his address acquired him such high favour that in 1739 he was appointed ambassador to London. The new minister, Peter di Motta, his enemy, recalled him in 1745; but the queen, who was his patroness, sent him to Vienna to act as mediator between the pope and the Empress Maria Theresa. Carvalho here gained general esteem, and his first wife being dead obtained the hand of the youthful Countess of Daun. The queen now procured his nomination as ambassador to the Spanish court; but the king and his minister hated him; he was recalled, and even the influence of the queen was insufficient to overcome the aversion of the king (John V.) This monarch died in 1750, and through the influence of the queen-dowager Carvalho obtained from his successor Joseph I. the post of secretary of state for foreign affairs. He soon rendered the feeble and sensual king (particularly after the death of the queen-mother, 1754) entirely subject to his influence. Joseph I. fell in with the most daring projects of his minister; and the latter now proceeded to the accomplishment of his four favourite objects—the expulsion of the Jesuits, the humiliation of the greater nobles, the restoration of the prosperity of Portugal, and the absolute command of the state in the name of the monarch. England, the Jesuits, and the nobility monopolized the wealth of the country, which was without an army or a fleet, without commerce or agriculture. It required a man of his character to withstand the attacks to which he was exposed from the Inquisition, whose *autos da fé* he prohibited; from the Jesuits, whom he expelled from their missions in Paraguay; from the leading nobles, whom he deprived of their princely possessions in the colonies; and from the prelacy, whose powers he abridged. Then came the earthquake of November 1, 1755, which destroyed Lisbon. Carvalho appeared in the midst of the general despair as a saviour, displaying a vigour and resolution which alone ought to have conciliated his enemies. The king submitted implicitly to his direction. Carvalho was now created Count of Oeyras, and in 1756 first minister. He then removed every one who ventured to obstruct his plans. But with the pride of the great, whom he humbled, and the avarice which his commercial regulations exasperated, was now connected the discontent of the country people, excited by his establishment of monopolies. The discontented vine-dressers committed excesses in Oporto, but Pombal vigorously suppressed the riots, and passed the most comprehensive laws against treason, which made the will of the king valid against all constitutions and privileges. He also exposed, to the astonishment of Europe, the conduct of the Jesuits in their government in Paraguay. In his *exposé* of this matter there are certainly many exaggerations, and there is no doubt that the fathers ruled these provinces much better than the government of Spain or Portugal would have done. Carvalho finally determined to remove the Jesuits entirely from the person of the king. They were deprived of the place of confessors, and were ordered (September 16, 1757) to retire to their colleges. Several Portuguese grandees who had joined in intrigues against the minister were banished from Lisbon. A conspiracy against the life of the king, who was wounded on the night of September 3, 1758, by assassins, delivered the minister's mortal enemies into his hands. Three months after the attempt Pombal arrested the Marquis of Tavora and his family, the Jesuit Malagrida, and the next day the Duke of Aveiro and others. The minister and a member of the supreme judicial tribunal conducted the examination, and after a hasty trial the Duke of Aveira and the Marquis of Tavora were broken on the wheel; the sons and the son-in-law, with the servants of the former, were strangled; the wife of the marquis was beheaded, and a servant of the duke burned. The minister denounced the Jesuits to the pope as the contrivers of the scheme, and not being able to procure immediately a bull permitting the secular tribunals to proceed against them, he caused some of them to be executed in prison. Malagrida, who had prophesied the death of the king, was condemned to the flames by the Inquisition, and burned in 1761. Pombal had already banished the whole order from the kingdom by a royal decree of September 3, 1759, and as they did not comply with the mandate caused them to be seized by the soldiers and transported to the States of the Church. These proceedings gave rise to a protracted dispute with the pope; in 1760 Pombal transported the Papal nuncio beyond the frontiers, and was on the point of dissolving all connection with Rome when Clement XIII. died, and Clement XIV., his successor, abolished the order in 1773. Portugal was soon after

involved in a short war with Spain, and at a subsequent period in a second war, on account of the minister's haughty conduct towards that government. The Portuguese army received an entirely new organization, and the fortifications on the frontiers were put in a better condition. Pombal was no less active in his efforts to improve the country in every relation, and paid particular attention to the schools; he also rendered the censorship less strict. Joseph I. died February 24, 1777, and was succeeded by his daughter Maria I., the bitter enemy of Pombal, whom she at once deprived of his offices. The state-prisoners whom he had incarcerated, 9800 in number, were released, and all his regulations were abolished. Pombal transferred to the young queen a treasure of 78,000,000 crusados, and a well-organized state. The nobility left no means untried to bring him to the scaffold. The queen caused an examination to be made into the trial of the assassins of the king, and Pombal saved himself only by exhibiting the original proofs of the conspiracy, which had not been made public. He retained his titles and his estates, and, retiring into the village of Pombal, died there 8th May, 1782.

POMEGRANATE (*Punica Granatum*, natural order Myrtaceæ). In its wild state this is a dense spiny shrub, 8 or 10 feet high, but when cultivated with care, and in a favourable climate, it attains double these dimensions. It is supposed to have originated in the north of Africa, and thence to have been introduced into Italy. By the Romans it was called *malum Punicum*, or Carthaginian apple, and the country adjacent to Carthage was then celebrated for its production. It is the *rimmôn* of Scripture. The leaves are opposite, lanceolate, entire and smooth; the flowers are of a brilliant red, large, and almost sessile; the fruit, when cultivated, attains the size of a large apple, and has a thick coriaceous rind, crowned at the summit with the teeth of the persistent calyx. It is filled with a multitude of small red seeds, and the pulp is more or less acid, and slightly astringent. The pomegranate is now naturalized as well as extensively cultivated throughout a great part of the south of Europe, for the sake of the fruit; and even in those climates where, like our own, this does not attain perfection, the beauty of the flowers renders it a favourite ornamental shrub. Numerous varieties have been produced, differing in the beauty of their flowers and in the taste and quality of the fruit. The pomegranate, in warm climates, sometimes attains a great size. A cooling and agreeable beverage is made of the juice mixed with water and sugar or honey. Another species (*P. nana*) inhabits the West Indies and Guiana, where it is sometimes used as a hedge plant. The flowers and fruit are very small.

POMERANIA (German, *Pommern*), a province and duchy in the northern part of Prussia, bounded north by the Baltic, west by the Duchy of Mecklenburg, south by the province of Brandenburg, and east by West Prussia; area, 12,000 square miles. It consists of a long and comparatively narrow tract of country, stretching longitudinally east to west. The coast is generally low and sandy, and is lined by a great number of lagoons, separated from the sea by narrow belts of land or low sandhills. The chief of these lagoons are the Binnensee, the Lebasee, and the Stettiner-haff or Pommersche-haff. The last forms the embouchure of the Oder, and communicates with the Baltic by three channels—the Peene, Swine, and Divenow. Owing to the general lowness of the coast, where it is not protected from the waves by the downs or low hills already mentioned, artificial embankments, like those of Holland, become necessary. Along the coast are a few islands, but none of them, except Rügen, Usedom, and Wollin, are of great extent. The interior is almost a continuous flat, including considerable marshy tracts, with a very gradual inclination towards the Baltic, by which all its drainage is received. The principal rivers are the Oder, Persante, and Stolpe. The soil on the whole is sandy and indifferent; still there are many rich alluvial tracts, particularly along the banks of the rivers and lakes, producing a surplus of grain for export. Much of what is thus exported is of the finest quality, and the Pomeranian wheat is well known in the English market, where it often commands the highest price. Flax, hemp, and tobacco are also cultivated. The domestic animals are numerous, and of tolerably good breeds: those which appear to attract most attention are sheep and swine. The forests are of large extent, and well supplied with game. Fish also are abundant. The only minerals of any consequence are a little iron, salt, and alum. Manufactures early made considerable progress, in consequence of the influx of French refugees on the revocation of the edict of Nantes, who introduced the manufacture of woollens and other fabrics. The possession of the Oder enables the province to carry on a considerable trade, both general and transit. The principal exports are corn, cattle, wood, wool, wax, amber, and fish; the principal imports are wine, cotton goods, coffee, sugar, and other articles of colonial produce. The centre of trade is Stettin, which ranks as one of the most important commercial cities of Prussia. Pomerania appears to have been originally inhabited by Goths, Vandals, and Slaves. The first mention of it in history is in 1140. It long remained an independent duchy, and was of much larger extent than at present. In 1637, on the extinction of the ducal family, the electoral house of Brandenburg claimed possession, but was obliged to give way to Sweden. On the death of Charles XII. the electoral house again claimed possession, and the whole was formally ceded to it except a part which received the name of Swedish Pomerania. This part having been ceded to Denmark, was by it given up in exchange for the Duchy of Lauenburg, to Prussia, to which the whole of Pomerania now belongs. For administrative purposes it is divided into three governments (Regierungs-bezirke), Stettin, Köslin, and Stralsund. Pop. (1880), 1,540,034.

POMONA, among the Romans the goddess of fruit, and wife of Vertumnus, who succeeded, after all the rustic gods had long vainly tried to secure her love, in obtaining both her heart and her hand. Her worship was confined to the Romans. At Rome she had her own priest (*flamen Pomonalis*), and was usually represented with a basket of fruit, or with fruit in her bosom. Often also she appeared with a garland of fruit encircling her head.

POMONA, or MAINLAND, the largest and most populous of the Orkney Islands, open to the Atlantic on the west and east, but separated by channels from Rowsa, Shapinsha, &c., on the north, and from Hoy, South Ronaldsha, &c., on the south. Length from north-west to south-east, 23 miles; extreme breadth about 15 miles, but at the town of Kirkwall only about 2½ miles; area, 150 square miles; pop. 17,165. It is extremely irregular in shape, and on all sides except the west is deeply indented by bays and creeks, among which are Kirkwall Bay, Scapa Flow, Inganess Bay, Deer Sound, Holm Sound, and another on the south-west, entering from Hoy Mouth, and communicating by a narrow strait with a large and beautiful expanse called the Loch of Stennis. The coast is bold and elevated on the north-west and west, where the ocean often breaks with tremendous fury; here and in other parts the action of the water

has produced several remarkable caverns. The general slope is eastward, and in that direction the beach often becomes low and sandy. The interior is diversified with hills, valley, and lakes, but wants the beauty which woods would give it, though in some of the more sheltered spots considerable plantations have recently been made. The surface is covered in great part by moor and heath, but good pasture is also to be found, and in the valleys a good loamy soil occurs. The principal towns are Kirkwall and Stromness. See ORKNEY.

POMPADOUR, JEANNE ANTOINETTE POISSON, MARQUISE DE, the mistress of Louis XV., in whose affections she succeeded Madame de Chateauroux. She was born on the 29th of December, 1721, and was the daughter of François Poisson, whom Jal proves to have been equerry to the Duke of Orleans, and not butcher to the Invalides, as frequently stated. The paternity of the future favourite was, however, claimed by Lenormand de Tournehem, a rich fermier général, who spared no pains to give the lovely child a brilliant fashionable education, and who at his death left her the half of his immense fortune. In 1741 she was married to her cousin Lenormand d'Etiolles, an ugly little man, who loved the beauty passionately, but in whom she only saw the means of obtaining a fixed position in society. Her ambition was fired by the infamous counsels of her mother, and the prophecy of a fortune-teller, that she would one day become the favourite of the king. The chateau d'Etiolles was surrounded by a forest in which Louis XV. often led the chase, and Madame d'Etiolles seized every opportunity of throwing herself in his way. She at last succeeded in attracting his attention, was formally presented to him, and soon entirely engrossed his favour. In 1745 she appeared at court under the title of Marquise de Pompadour. Here she enjoyed the highest consideration, but did not at first interfere in political affairs, satisfied with appearing as the patroness of learning and the arts. She collected books, pictures, and curiosities, and encouraged the institution of the military school of which Paris du Verney was the founder. But when her charms began to fade, and she could only maintain her influence with the king by furnishing him other objects for the gratification of his passions, she turned her attention to state affairs. She filled the most important offices with her favourites, and contributed to produce those evils which afterwards pressed so heavily on France. It is said to have been principally owing to her that France became involved in the war against Frederick II. The Empress Maria Theresa had propitiated her favour by writing to her with her own hand, in which she called her 'dear cousin.' The burdens and sufferings which this war brought upon France must be laid at her door, since she removed Bernis, who was in favour of peace, and supplied his place by Choiseul, effected the recall of Marshal d'Estrées at the moment of triumph, and promoted incapable generals to the command. She died in 1764, at the age of forty-four years, little regretted by the king (see LOUIS XV.), and hated and reviled by the nation. The memoirs and letters which appeared under her name are not genuine, but are attributed to the younger Crébillon. See the Mémoires of Mad. Campan, and those of Du Hausset.

POMPEII, an ancient city of Campania, situated on the Bay of Naples, about 12 miles south-east from the city of that name, at the mouth of the river Sarno (the ancient Sarnus), and immediately at the foot of Mount Vesuvius. All accounts agree in representing it as a very ancient city, and a tradition ascribed its foundation to Hercules. According to Strabo it was first occupied by the Oscans, subsequently by the Tyrrhenians and Pelasgians, and afterwards by the Samnites, in whose hands it continued till it came into the possession of the Romans. It probably became from an early period a flourishing commercial town, owing to its advantageous position at the mouth of the river, which was formerly navigable for a short distance above the city, and which rendered it the port of Nola, Nuceria, and all the rich plain watered by the Sarnus. But no mention of its name is met with in history until 310 B.C., when a Roman fleet touched there, and landed troops, who ravaged the territory of Nuceria. We find no subsequent notice of it till the outbreak of the Social war (91 B.C.) The rebels were defeated in the vicinity by Sulla, who afterwards laid siege to the town itself. Whether it fell into his hands by force or capitulation we cannot now tell, probably the latter, as it escaped the fate of Stabiæ, and its inhabitants were admitted to the Roman franchise, though they had to relinquish a third of their arable land to a colony of soldiers sent thither 82 B.C. Before the close of the republic Pompeii became a favourite retreat of Romans of the wealthier classes, who purchased estates in the vicinity, Cicero among others having a villa there. Under the early emperors it continued to be resorted to for the same purpose. Seneca praises its pleasant situation, and Tacitus calls it a populous and flourishing town. The last-mentioned writer records a serious conflict which took place in the amphitheatre between the Pompeians and the newly-settled colonists of Nuceria (59 A.D.), in consequence of which the former were prohibited from having theatrical and gladiatorial exhibitions for a period of ten years. Four years later (63 A.D.) a fearful earthquake occurred, which destroyed most of the public edifices and many of the private houses of the town. The citizens abandoned it for some time, and the Roman senate even contemplated prohibiting its reconstruction. At the end of a few months the work of rebuilding was commenced and carried rapidly forward. The new town was not quite completed, however, when it was overtaken by the catastrophe of 24th August, 79. The first premonitory symptom was a dense shower of ashes thrown from the flaming crater of Vesuvius, which covered the town with a stratum about 3 feet in depth, and which allowed the greater number of the inhabitants to escape. Many of them returned, some doubtless to rescue their valuables; others, paralyzed with fear, and not knowing whither to turn their steps. The number of skeletons of those who thus perished in one-third part of the town already excavated is variously stated from 400 to 600. The ashes were followed by a stupendous shower of red-hot *rapilli* (fragments of pumice-stone of all sizes), which covered the town to a depth of 7 to 8 feet, and was succeeded by fresh showers of ashes, and again by rapilli. No lava current seems to have ever reached the town. The present superincumbent mass is about 20 feet in thickness. A portion of this was formed by subsequent eruptions, but the town had been buried by the first catastrophe and entirely lost to view. A small straggling village, which sprang up on or near the spot, long served to maintain the name, but after the eruption of 472 the site was finally abandoned, and during the middle ages Pompeii was consigned to oblivion. In 1592 the great engineer and architect Domenico Fontana constructed a subterranean water-conduit for conveying the water of the Sarno to Torre dell' Annunziata, actually intersecting the ruins, yet no further excavations were made. It was not until 1748, when a peasant in sinking a well discovered a painted chamber with statues and other objects of antiquity, that anything like a real interest in the locality was

E. Bosc, del. Imp. F. Dulac, Paris. Charpentier, lith.

ATRIUM, OR COURT OF HOUSE IN POMPEII, RESTORED.

BLACKIE & SON, LONDON, GLASGOW & EDINBURGH.

excited. Charles III., in whom the discovery of Herculaneum had awakened a desire for further explorations, ordered the excavations to be prosecuted. In 1755 the amphitheatre, theatre, and other parts were cleared out. Under the Bourbons the excavations were carried out on a very unsatisfactory plan. Statues and articles of value alone were extricated, whilst the buildings were suffered to fall into decay or covered up again. To the short reign of Murat (1808–15) we are indebted for the excavation of the Forum, the town walls, the Street of Tombs, and many private houses. The political changes of 1860 have likewise produced a beneficial effect. The government of Victor Emmanuel has assigned £2500 annually for the prosecution of the excavations, and a regular plan has been adopted, according to which the ruins are systematically explored and carefully preserved. A local museum and library have been instituted, and a railway constructed for the removal of the *débris*. It is calculated that at the average present rate of working it will require upwards of sixty years to lay bare what of the city still remains covered.

The town is built in the form of an irregular oval, extending from east to west. The circumference of the walls amounts to 2925 yards. There are eight gates, to which the following names have been given: Porta di Ercolano, della Marina, di Stabia, di Nocera, del Sarno, di Nola, di Capoa, del Vesuvio. Towards the sea the walls, which were built of large uncemented blocks of volcanic tufa and travertine, have been demolished. Outside the Porto di Ercolano a considerable settlement had sprung up, termed Pagus Augustus Felix, after the settlement established by Augustus. The area inclosed within the walls is estimated at 160 acres; greatest length, ¾ mile; greatest breadth, ½ mile. The excavated part includes probably the most important part of the town, comprising the Forum, with the contiguous temples and public buildings; two theatres with large porticoes, the amphitheatre, and a considerable number of handsome private dwellings. The principal streets have been called the Via Domitiana, the Strada di Mercurio, delle Terme, della Fortuna, dell' Abbondanza, dei Diadumeni, dell' Anfitreato, Stabiana. These streets, bordered by pavement, are straight and narrow, not above 24 feet broad, the narrower lanes being about 14 feet. They are admirably paved with large polygonal blocks of lava. At intervals, especially at the corners, are placed high stepping-stones, leading from one side of the pavement to the other, intended for the convenience of foot-passengers in wet weather. The waggons have worn deep ruts in the causeways, which do not exceed 4½ feet in width. At the corners of the streets are public fountains, decorated with the head of a god, a mask, or similar ornament. The houses are slightly constructed of concrete, or bricks occasionally, especially the corner pillars of tufa blocks. The hasty patchy style of construction is accounted for by the earthquake of 63. The numerous and well-preserved staircases prove that the houses must have had a second, perhaps a third story. These upper portions, consisting chiefly of wood, have, with a single exception, been destroyed by the red-hot scoriæ of the eruption. The front of the ground-floor of the larger houses was generally occupied by shops; where there were no shops the outer walls were stuccoed and generally painted, often in bright colours; the upper floors alone had small windows, owing to the absence of glass. The chief peculiarity of the habitations is the internal court, which provided the surrounding chambers with light, and was the medium of communication between them. Most of those Pompeian houses which belonged to the wealthy middle-class are entered from the street by a narrow passage (*vestibulum*) leading to the court (*atrium*), surrounded by a covered passage, with the *impluvium* or reservoir for rain-water in the centre. Beyond the atrium is a large apartment opening on to it, termed the *tabulinum*, in which the patron received his clients, transacted business, &c. The other portion of the house was devoted to the use of the family. Its centre also consisted of an open court inclosed by columns, thence called the *peristylium*, the middle of which was laid out as a garden. Beyond the peristyle lay sometimes a private garden (*xystos*) surrounded by columns. At the back of the peristyle were sometimes several business-rooms, termed *œci*. Round these apartments are situated the sleeping and eating rooms, slaves' rooms, kitchen, cellar, &c. All the apartments are small; the walls are sometimes covered with paintings, generally of an erotic character. Pl. CLX. is a view of the atrium of a Pompeian house, and is also a fine representation of architectural polychromy. The shops were small, and all of one character, having the business part in front, and one or two small chambers behind. They were open to the street, and closed by wide sliding shutters or doors moving in grooves cut in the stone, in some instances upon an iron rail. In front the shops had a broad counter of masonry, with little steps at the end next the wall for the display of goods, and a small oven at the opposite end when the articles sold were food or drink. Many of these counters, covered with marble, and sometimes fitted up with earthen vessels for the sale of wine, oil, &c., are still preserved. Trade-signs like those of the present day are rare. In the streets are frequently seen notices painted in red letters, referring generally to municipal elections, and recommending some particular person as ædile or duumvir. The Forum, lying in the heart of the town, consists of an area or open space surrounded by buildings. On the north side stands the so-called Temple of Jupiter; on the west the Temple of Venus and the Basilica; on the south the three tribunals or courts of justice; on the east the edifice built by the priestess Eumachia, and called Chalcidicum (probably employed as an exchange), the Temple of Mercury, the Curia or Senaculum, and the Pantheon or Temple of Augustus. The inclosed area is 565 feet long and 119 feet broad; it is paved with large stone slabs, and is bordered by a colonnade. The other important public buildings are the Great Thermæ, the Great Theatre, the Small Theatre or Odeum, the Temple of Isis, and the Greek Temple or Temple of Neptune (the most ancient building yet discovered), and the amphitheatre. Among the more interesting private buildings scattered through the town are the villa of Diomedes, in the Strada dei Sepolcri; the house of Sallust, in the Strada di Ercolano; the house of Pansa, that of Apollo, and that of the Tragic Poet, in the Strada delle Terme; the house of Meleager, and that of Castor and Pollux, in the Strada di Mercurio; the house of the Faun, in the Strada della Fortuna; the house of Marcus Lucretius, in the Strada di Stabia. The houses have received these names from inscriptions, statues, or paintings found in them. The museum of Naples owes its most interesting features to the manuscripts, coins, statues, paintings, domestic utensils, &c., found in the public and private edifices above mentioned. See Sir W. Gell's Pompeiana (four vols. 1824–30); Dyer's Pompeii (one vol. 8vo, London, 1867); Overbeck's Pompeii (Leipzig, 1866); Monnier's Pompéii et les Pompéiens (Paris, 1864); and the great work of Mazois, Les Ruines de Pompéii (four vols. folio, Paris, 1812–38).

POMPEY (Cneius Pompeius), surnamed the Great (*Magnus*), born B.C. 106, was the son of Cneius Pompeius Strabo, an able general, but hated for his

severity and avarice. In B.C. 89 he served under his father in the war against the Italian allies, fighting with great distinction until the general's death in 87. For some years subsequently the party of Marius was in the ascendant in Italy, and Pompey, who belonged to the aristocratic party, kept in the background. As soon as he learned, however, that Sulla was about to return from Greece to Italy, he hastened into Picenum, where his estates lay, and raised an army of three legions, with which he successively defeated three generals of the opposite party, who attempted to prevent his junction with Sulla. That junction was accomplished in 83, and Sulla received the young soldier with the greatest marks of esteem, saluting him as *imperator*, although he had not yet reached the senatorial age, being but twenty-three years old. When the war in Italy was brought to an end Pompey was sent to Sicily against the Marian general, M. Perperna Vento, whom he soon drove from the island (82). The following year he crossed over to Africa, where the Marian party had collected a force under Cn. Domitius Ahenobarbus, with whom was leagued Hiarbas, king of Numidia. At the head of five legions Pompey came suddenly upon the enemy and completely routed them, killing Domitius and taking Hiarbas captive. This decisive success, which occupied only fourteen days, excited the jealousy of Sulla, who commanded him to dismiss his forces and return to Rome. On his return he was received by the people with great enthusiasm, and Sulla greeted him with the surname of Magnus, which he continued to bear afterwards, and which descended to his sons. Not content with this empty distinction, Pompey demanded a triumph, which Sulla at first refused, but fearing his young rival's increasing popularity, at last consented to. Pompey therefore entered Rome in triumph in September, 81, before he was twenty-five years of age, and was the first Roman permitted to do so without possessing a higher dignity than that of equestrian rank. After the death of Sulla in 78 new troubles broke out, occasioned principally by the ambitious projects of the consul Lepidus, who aimed at the supreme power. When Lepidus had recourse to arms in 77, Pompey took an active part in the war against him, and with the assistance of the consul Catulus, at last succeeded in crushing him and his party. On quiet being restored Catulus called upon Pompey to disband his troops. This he evaded under various pretexts, until the progress of Sertorius, formerly a general in the service of Marius, induced the senate, though with reluctance, to send him to the aid of Metellus Pius, who was hard pressed by Sertorius in Spain. Pompey remained in Spain between five and six years (76–71), but neither he nor Metellus could gain any advantage over Sertorius. But when the latter was treacherously murdered by Perperna, his own officer, the war was speedily brought to a close. Pompey easily defeated Perperna in the first battle, and all Spain was subdued by the early part of 71. On his return to Italy at the head of his troops Pompey found the servile war raging. Crassus had already gained a decisive victory over Spartacus, the rebel leader, and all that Pompey had to do was to cut to pieces the scattered fugitives he came up with on his advance to Rome. For this he claimed the glory of having finished the servile war, and the honour of a second triumph. He now became a candidate for the consulship, and the people were so charmed with the successes of the young general, that although he was not of the legal age, and had not held any of the lower offices of the state, he was elected consul along with Crassus at the end of the year 71. The aristocracy began to look upon Pompey with jealousy, and ceased to regard him as belonging to their party, as he and his colleague openly courted the people—Crassus, by his profuse largesses, and Pompey by the restoration of the tribuneship and other popular institutions. In 67 he was invested with extraordinary powers by sea and land for three years, for the purpose of putting an end to the outrages of the pirates who were then masters of the Mediterranean. He made his preparations for the war in the end of winter, entered upon it in the beginning of spring, and by the middle of summer he cleared the sea of the pirates, and destroyed their strongholds on the coast of Cilicia. Over 20,000 pirates were taken prisoners, many of whom he settled at Soli in Cilicia, which was henceforward called Pompeiopolis. Meanwhile the war against Mithridates had been carried on with various fortune, and the Romans were beginning to get discontented with the slow progress of Lucullus. The tribune, C. Manilius, proposed that the command should be given to Pompey, who was to have absolute power over the army and fleet in the East, and proconsular authority over all Asia as far as Armenia, a proposal which was supported by Cicero in the famous oration Pro Lege Manilia. It was opposed by the whole influence of the aristocracy, but carried triumphantly. In the four years 65–62 he conquered Mithridates; Tigranes, king of Armenia; and Antiochus, king of Syria. At the same time he subdued the Jewish nation, taking Jerusalem by storm after a three months' siege. He returned to Italy in 62, and immediately disbanded his army, but did not enter Rome till the following year, when he had the honour of a third triumph. From this date, when he was forty-five years of age, his star began to wane. He was now called upon to play a prominent part in the civil commotions of the state, a *rôle* for which neither his natural talents nor his previous training in the least suited him. The aristocracy still looked upon him with distrust, yet he was unwilling to throw in his lot entirely with the popular party, which had been steadily rising in power during his absence, and over which Cæsar now possessed unlimited control. The senate, who hated and feared him, refused to sanction his measures in Asia, and to make an assignment of lands which he had promised to his veterans. Pompey therefore resolved to ally himself closely with Cæsar, who promised to obtain the ratification of his acts provided Pompey would assist him in the attainment of his ends. Through the mediation of Cæsar Pompey became reconciled to Crassus, who, in consequence of his enormous wealth, had a wide influence in Rome. Thus was brought about the coalition of these three powerful men, which is known in Roman history as the first triumvirate, and which for a time swept away all the opposition the aristocratic party could organize against it. During Cæsar's consulship all his measures were carried. Pompey's acts in Asia were all ratified, and Cæsar's agrarian law, which partitioned the Campanian land among the poorer citizens, enabled Pompey to fulfil his promises to his soldiers. In order to tighten the bonds of alliance Cæsar bestowed upon Pompey his daughter Julia in marriage. It was soon apparent that this alliance would not last long. While Cæsar spent the next few years reaping laurels in Gaul, Pompey was gradually losing the confidence of all parties at Rome; yet he could not bear the thought of being the second man in the commonwealth, and he struggled hard to obtain the dictatorship. The death of Julia in 54 severed one of the ties which bound the two men who were soon to become open and deadly rivals. In consequence of the serious tumults which broke out in Rome on the death of Clodius in the beginning of 52, the senate called in the assistance of Pompey, who was appointed sole consul for that

year, and who succeeded in restoring order in the city. The most important state offices were now filled with Cæsar's enemies, and Pompey persuaded the senate to pass a decree by which Cæsar was to give up the provinces of which he was governor, and the command of his army. This he refused to do unless Pompey would throw up his offices, which was a step the latter would not take. Cæsar was proclaimed an enemy to the state, and his rival was appointed general of the army of the republic. Cæsar crossed the Rubicon in 49, and in sixty days he was master of Italy without striking a blow. Pompey fled to Greece, where he collected a numerous army, and whither he was followed by Cæsar in January, 48. At first the campaign was in Pompey's favour; Cæsar was repulsed before Dyrrhachium with considerable loss, and was compelled to retreat towards Thessaly. In this country, on the plains of Pharsalia, occurred the decisive battle which made Cæsar master of the Roman world. His rival fled to Egypt, where he hoped to meet with a favourable reception, as he had restored the young king's father to his kingdom. The Egyptian ministers, dreading Cæsar's vengeance if they favoured his enemy, resolved to get Pompey into their power and put him to death. Accordingly while he was sailing along the coast a boat was sent out to his ship, and he was invited to land. As he was about to step on shore he was stabbed by one of his former centurions (29th September, 48). His head was struck off, and was shown to Cæsar when he arrived in Egypt some time afterwards. He turned away from the sight with tears, rewarded his followers liberally, punished his murderers, and erected over his remains a temple to Nemesis.

POMPEY'S PILLAR, a celebrated column, standing on an eminence about 1800 feet to the south of the present walls of Alexandria in Egypt. It consists of a capital, shaft, base, and pedestal, which last rests on substructions of smaller blocks once belonging to older monuments. One of these blocks bears the name of a monarch of the thirteenth Egyptian dynasty, and another that of Psammetichus I. The total height of the column is 98 feet 9 inches; the shaft, a monolith of red granite, is 73 feet long, and 29 feet 8 inches in circumference. The shaft is elegant and of good style, but the capital and pedestal are of inferior workmanship, and have the appearance of being of a different epoch. The name it is popularly known by was applied to it by ancient travellers for no assignable reason. An inscription on the base shows that it was erected by Publius, the præfect of Egypt, in honour of Diocletian, probably to commemorate his capture of Alexandria, and the suppression of the rebellion of Achilleus. On the summit there is a circular depression of considerable size, intended to admit the base of a statue; and, indeed, in an old picture of Alexandria the figure of a man is represented as standing on the column. Arabic writers state that it stood in a *stoa* surrounded by 400 columns, where the library was contained which Omar burned.

POMPONIUS MELA. See MELA.

PONCE DE LEON, JUAN, one of the early Spanish discoverers in America, accompanied Columbus on his second expedition in 1493, and was sent by Ovando to conquer the island of Porto Rico. Having there amassed great wealth, and received information of an island situated to the north, in which there was a miraculous fountain possessing the power of restoring youth to the aged, he sailed in 1512 in quest of these happy shores. Although he was unable to find the fountain of youth, he discovered the country to which he gave the name of Florida. Ponce returned to Spain in 1513, and was appointed by Ferdinand governor of the island of Florida, as he called it, on condition that he should colonize it. In 1521 he embarked nearly all his wealth in two ships, and proceeded to take possession of his province. He was, however, met with determined hostility by the natives, who on one occasion made a sudden attack upon the Spaniards, and drove them to their ships. In the combat Ponce de Leon was mortally wounded, and died after his arrival at Cuba in 1521.

PONCE DE LEON, LUIS, a Spanish lyric poet, born in 1527, probably at Granada. He entered the order of St. Augustine at the age of sixteen, became licentiate in theology in 1560, and doctor of divinity shortly afterwards. At the age of thirty-four he was appointed professor of theology at Salamanca, and ten years later obtained the professorship of sacred literature. At the request of some friends he translated the Song of Solomon into Castilian, and the manuscript falling into the hands of some persons who were envious of his talents and success he was brought before the tribunal of the Inquisition at Valladolid, in 1572, on the charges of Lutheranism, and of translating the sacred writings contrary to decrees of the Council of Trent. The first charge could not be sustained against him, but as he could not deny the second he was thrown into prison. At the end of five years he was liberated and reinstated in all his offices in the university, where, in December, 1572, he resumed his lectures after the long intermission with the simple remark: 'As we observed in our last discourse.' At the time of his death (23d August, 1591) he had just been elected head of his order, and was drawing up regulations for its reform. His original productions, which are not numerous, are chiefly of a religious character. They were first published by his friend Quevedo at Madrid, in 1631, under the title Obras Proprias, y Traduciones. They contain translations from Virgil, Horace, and other classical poets, and from the Psalms and the book of Job, and have been frequently reprinted. Among his most popular prose works are his Perfecta Casada, De los Nombres de Christo, &c. One of the best editions of his works is that published at Madrid, in six vols. (1804–16). See Ticknor's History of Spanish Literature.

PONCHO, a kind of cloak much worn by the male inhabitants of Chili and other parts of South America. It is a piece of thick woollen cloth from 5 to 7 feet long and 3 to 4 feet broad, with a hole in the centre for the head to pass through.

PONDICHERRY (French, *Pondichéry*), a town, capital of the French possessions in Hindustan, on the east or Coromandel coast, 85 miles south by west from Madras. Its territory is surrounded on the land side by the British district of South Arcot. It stands on a sandy beach, and consists of two divisions separated by a canal. The 'White Town,' or European quarter, on the east, facing the sea, is very regularly laid out, contains a spacious square, in which is the government-house, handsome planted boulevards, and between 400 and 500 well-built houses, stuccoed white or yellow, mostly with terraces on their summits, and furnished with a colonnade below. The 'Black Town,' or native quarter, on the west beyond the canal, contains about 3800 houses or huts of brick or earth, and a few pagodas. Its streets are broad and shaded by palm-trees, but, as usual with Hindu towns, it is filthy. A large bazaar, two churches, a lighthouse, a public library, college for European children, several other public schools, a botanic garden, and a mont de piété are the chief edifices and institutions. The fortifications, formerly strong, were destroyed during the war with the British, and by the Treaty of Paris they are not to be rebuilt, nor is Pondicherry to be garrisoned by a native French

force. The territory around the town has an area of 107 square miles, and is partly watered by the Gingee River, but is not very fertile: some rice, indigo, tobacco, betel, cotton, and cocoa-nuts are raised; which, with guinees or fine cotton cloths dyed blue, India handkerchiefs, and cotton yarn, form the chief exports. The imports consist chiefly of lace, fancy goods, jewelry, furniture, books, &c. The trade is declining, there being no harbour, but only a roadstead, on which the surf beats almost as strongly as at Madras. The settlement was purchased by the French from the Bejapoor rajah in 1672, and taken by the British in 1761, 1778, 1793, and 1803. Pop. of the town, 48,135.

PONDWEED. See POTAMOGETON.

PONIATOWSKI, the name of an illustrious Polish family descended from an Italian stock.—GIUSEPPE SALINGUERRA (born 1612), belonging to the old Italian family Torelli, having settled in Poland, after the murder of all his house by Ranuzio I., duke of Parma, took the name of Eziolek, and afterwards that of Poniatowski, from an estate Poniatow of his wife, the daughter of Albert Poniatowski and Anna Leczinska. His descendants received the title of prince in 1764.—STANISLAW, Count Poniatowski (born 1678; died 1762), is known for his connection with Charles XII., whom, after the battle of Poltava, he followed into Turkey, and as whose ambassador at Constantinople he had the address to involve the porte in a war with Russia. He wrote Remarques d'un Seigneur Polonais sur l'Histoire de Charles XII. par Voltaire (Hague, 1741).—His eldest son, STANISLAW AUGUSTUS (born 1732), the favourite of Catharine II., was elected king of Poland, under the influence of Russian bayonets, in 1764. See STANISLAW.—JOZEF, the nephew of King Stanislaw, born in 1762, served with courage against the Russians in 1792, and on the accession of his uncle to the confederation of Targowitz, left the service with most of the best officers. When the Poles attempted in 1794 to drive the Russians out of the country, he again joined the Polish camp as a volunteer. Kosciusko gave him the command of a division, at the head of which he distinguished himself at the two sieges of Warsaw. After the surrender of the city he went to Vienna, and, rejecting the offers of Catharine and Paul, lived in retirement on his return to Poland, at his estates near Warsaw. The creation of the Duchy of Warsaw rekindled the hopes of the Polish patriots, and Poniatowski accepted the place of minister of war in the new state. In 1809 he commanded the Polish army against the superior Austrian force which was sent to occupy the duchy, compelled it to retire, rather by skilful manœuvres than by force of arms, and penetrated into Galicia. In the war of 1812, against Russia, he was again at the head of the Polish forces, and distinguished himself throughout this checkered campaign. After the battle of Leipzig, during which Napoleon created him marshal of France, he was ordered (October 19) to cover the retreat of the French army. The enemy were already in possession of the suburbs of Leipzig, and had thrown light troops over the Elster, when the prince arrived with a few followers at the river, the bridge over which had been blown up by the French. Poniatowski, already wounded, plunged with his horse into the stream, which swallowed up horse and rider. His body was first found on the 24th, and buried with all the honours of his rank on the 26th. It was afterwards removed to Warsaw, and in 1816 was deposited in the cathedral at Cracow. An equestrian statue of Poniatowski was executed for the city of Warsaw by Thorwaldsen.

PONTA-DELGADA, or PONTE-DELGADA, a town on the south side of the island of St. Michael, one of the Azores. It is defended on the sea side, on the west by the castle of St. Braz, which can mount ninety pieces of cannon; and about 3 miles to the east by the forts of São Pedro and Rosto de Cão. It is built with considerable regularity, and the houses have a substantial and cheerful appearance, but the streets are wretchedly paved. The principal buildings are six churches, eight monasteries, and four convents, now suppressed, and a neat English chapel. The anchorage in the roadstead is bad, and the harbour is so shallow that vessels require to be loaded by means of small craft; but still the trade is considerable. It is chiefly in the hands of the British, of whom a considerable number are here resident, including a consul. The chief exports are wheat, maize, and oranges; and the imports, cotton and silk tissues, hardware, &c. Pop. estimated from 16,000 to 20,000.

PONT-A-MOUSSON, a town of France, in the department of Meurthe-et-Moselle, 16 miles north-west of Nancy, on both sides of the Moselle, here crossed by a bridge. It has a fine square surrounded by arcades, a handsome Gothic church dedicated to St. Martin; the old abbey of St. Mary, now converted into a seminary; a communal college, and other educational institutions. There are tanneries, potteries, breweries, and oil-works, and a trade in wine, corn, wood, &c. It fell into the hands of the Germans in August, 1870, and was evacuated in 1873. Pop. (1881), 11,293.

PONTCHARTRAIN, a lake of Louisiana, about 5 miles north of New Orleans, about 40 miles long from east to west, and nearly 25 in breadth. The water is generally from 12 to 14 feet deep. It communicates with Lake Borgne on the east, with Lake Maurepas on the west, and with New Orleans on the south, by Bayou St. John and a canal, and also by a railroad. It is surrounded by marshes, and the landing is generally difficult.

PONTE-CORVO, a town, Italy, in the province of Terra di Lavoro, and 20 miles south-east of Frosinone, in an isolated territory, on the left bank of the Garigliano. It is the see of a bishop, and has a castle, a cathedral, and six other churches. It was the capital of a principality created by Napoleon I., and from which Bernadotte had his title of Prince de Ponte-Corvo. Pop. 9314.

PONTEFRACT, or colloquially, POMFRET, a municipal and parliamentary borough, and market town, England, in the county and 24 miles S.S.W. of York, on a height near the confluence of the Aire and Calder, with stations on the Midland, North-Eastern, and Lancashire and Yorkshire Railways. It is well built, mostly of brick, and among its edifices the parish church is conspicuous from its elevated site and lofty tower; there are also the remains of a more ancient church, and of a Norman castle, which was the scene of the murder of Richard II. and other atrocities. This was the last garrison to hold out for Charles I., and was dismantled in 1649. One of the hospitals of the town dates from Saxon times, being supposed to have been founded by Ethelburga, the queen of Edwin of Northumbria. The chief manufactures are iron and brass castings, earthenware, bricks, tiles, pipes, &c.; and there is considerable trade in malt, corn, and liquorice, particularly in the form of the small lozenges known and highly esteemed for centuries, under the name of Pontefract cakes. There are large collieries, and also extensive gardens and nurseries in the vicinity. Pop. of the municipal borough, 8798; parliamentary borough, 15,332. It sends two members to Parliament, the earliest return being that of 1295, so that the borough is one of the oldest in the kingdom.

PONTEVEDRA, a town in Spain, Galicia, capital of a province of the same name, at the point where the

Lerez, Alba, and Tormez unite before falling into the Bay of Pontevedra in the Atlantic. It is surrounded by an old wall; consists of broad, well-paved streets, and well-built houses of granite, and has two churches, one of them a beautiful Gothic structure; and an old Franciscan convent, now used as a court-house. There are manufactures of cotton velvet, woollen and cotton cloth, hats, leather, &c.; fishing is actively carried on. Pontevedra was repeatedly sacked during the Napoleonic wars. Pop. 19,857.—The province, bounded on the south by Portugal, and on the west by the Atlantic, has a fertile soil and a good climate; produces in abundance maize, rye, wheat and millet, flax, fruit, and wine, and rears great numbers of cattle. Area 1739 square miles; pop. 451,946.

PONTHIEU, an ancient county of France, in the government of Picardie, bounded on the north by the river Canche, on the south by the Bresle, on the west by the Atlantic, and on the east by the county of Artois and the bailiwick of Amiens. It was traversed by the Somme from the south-east to the north-west, which divided it into North Ponthieu (or Ponthieu Proper) and South Ponthieu, or Vimeu. The principal towns of Ponthieu were Abbeville, the capital, Montreuil, Rue, St. Riquier, Crécy, and Le Crotoy; the principal town of Vimeu was St. Valery. The greater part of Ponthieu belonged originally to the Abbey of St. Riquier and other monasteries, but passed into the hands of counts, who became independent and hereditary towards the end of the tenth century. It passed by marriage to the counts of Alençon about 1100, and was ravaged by Henry II. of England in 1168. In 1221 it came into possession of Simon Dammartin, count of Aumale. Between the years 1279 and 1435 it frequently changed hands, the contending parties being the English and French kings. In the latter year it was finally wrested from the English by Charles VII., and pledged by him to Philip of Burgundy. On the death of Charles the Bold, in 1477, the Burgundians were expelled, and the county was reunited to the French crown.

PONTIANAK, a town on the west coast of Borneo, on both sides the Pontianak, capital of the Dutch province and kingdom of its name, almost on the equator; lon. 109° 20′ E. It has some trade in gold-dust and edible birds'-nests. Pop. 7000, about a third of whom are Chinese.—The province extends along the west coast of the island, from the frontier of Sambas, lat. 0° 30′ N. to lat. 3° S.; and includes the districts or states of Mampawa, Landak, Tayang, Succadana, &c.; on its coast are numerous islands. It is watered by the Sintang, Pontianak, and numerous smaller streams; and in its northern part has a large lake named Maleyoe or Malaju. It produces pepper, sago, rice, rattans, sugar, oil, wax, birds'-nests, diamonds, and gold, of which last there are several rich mines. Some cotton and silk stuffs are made by the Bugis; and opium, rice, salt, linen, and Chinese wares are imported. Pop. 337,772.—The kingdom is now limited to the delta of the river Pontianak. It is marshy and damp, and the temperature ranges from 84° to 89° Fahr.—The river rises partly in Lake Maleyoe, and partly in a stream flowing from a mountain range near the centre of the island. It flows W.S.W., in a very crooked course, past the chief towns of the small states of Salat, Selimbauw, Sintang, Sekadoe, Sangoei, Miliouw, and Tayang, and falls into the sea along with the Simpang and Sintang, by nine mouths; total direct course about 340 miles.

PONTIFEX, a priest who served no particular divinity. The Roman pontifices formed the most illustrious among the great colleges of priests. Their institution, like that of all important matters of religion, was ascribed to Numa. This king limited the number of pontifices to four, exclusive of the *pontifex maximus* or chief priest. The Ogulnian Law (300 B.C.) raised this number to eight, or including the pontifex maximus to nine, four of whom were to be plebeians. Sulla increased the number to fifteen, and Julius Cæsar to sixteen, including in both these instances the pontifex maximus. The duty of this dignitary was the inauguration of the priests, and in earlier times the care of the public records (*annales maximi*). He also superintended the sacred rites of Vesta. He held his office for life, and could not leave Italy. The emperors afterwards assumed this title until the time of Theodosius, and it was subsequently assumed by the Christian Bishop of Rome. The pagan pontifices had the supreme superintendence of the religious worship and its ministers, directed the religious solemnities, had the care of the calendar, and decided lawsuits which were connected with religion (hence the *jus pontificum*). The external badge of the pontifex, at least on solemn occasions and while engaged in the duties of his office, was a dress bordered with purple (*toga prætexta*), and a tapering hat in the form of a cone, which was made of the skins of sacrificed animals (*tutulus* or *galerus*).

PONTIFICAL, the book containing the prayers and rites to be used by the pope and bishops in the exercise of their functions, as confirming, conferring orders, consecrating bishops and churches, &c. Some writers have maintained that the Roman Pontifical is the work of Pope Gregory the Great, while others attribute its formation to Pope Gelasius, who flourished a century before him. The true account of it seems to be that which assigns its first form to Gelasius, while it was recast by Gregory, who made a considerable number of emendations upon it in the way of deletions, modifications, and additions. In this form, with a few subsequent alterations, and as published by the authority of Clement VIII., in 1596, it is used at the present day throughout the whole of the Western Church.

PONTIFICATE. The pope being called *pontiff*, the time of his government is called his *pontificate*.

PONTINE MARSHES (Italian, *Paludi Pontine*; Latin, *Pomptinæ Paludes*), an extensive tract of land in Italy, south of Rome, and forming the south-west part of the delegation of Frosinone. It extends from Ponte to Terracina, and has a length of 24 miles, with a mean breadth of 7 miles, and an area of about 80 square miles. The origin of these marshes is lost in the most remote antiquity. It is assumed that they were once covered by the sea, from the circumstance that Homer describes the abode of Circe, which is conceived to be what is now known as Monte Circello, as an island. From physical considerations, however, it is concluded that their formation must be assigned to a date considerably anterior to that usually assigned to Homer. In the early times of the Roman Republic there were, according to Pliny, on the testimony of former historians, thirty-three cities situated in this region, all of which disappeared at a very early period. It is doubted, however, whether this account is worthy of credit, as well from the improbability of the thing in itself, as from the fact that it receives no corroboration from any other early historian, and not even the names of any of the cities are preserved. The marshes, which are generally represented as deriving their name from the city of Suessa Pometia, situated somewhere on their borders, are formed by innumerable streams, which, rising in the neighbouring mountains, run into the plain, where, for want of a sufficient declivity towards the sea, they pass off very slowly, become stagnant, and at length lose themselves in the sand. The loss of so great a portion of fertile land, and the unwholesome vapours, which the south

wind often carried even to Rome, early attracted the attention of the Romans, and they sought to devise some scheme for remedying this evil. Appius Claudius (312 B.C.) probably made the first attempts at draining them when he carried the celebrated Appian Way through the marshes. He was succeeded in this attempt by the consul Cethegus (160 B.C.) Julius Cæsar formed the gigantic plan of conducting the Tiber through the marshes; but he was prevented by death from its execution. Augustus contented himself with undertaking several canals. Under the succeeding emperors these attempts to improve this part of the country were abandoned; and the water overflowed, till Nero renewed the work. Trajan continued it during ten years with so much spirit that the whole tract from Treponti to Terracina was drained, and the Appian Way was completely restored. During the political storms which destroyed the Roman Empire the marshes also reverted to their former dreary condition. Under the Gothic king Theodoric attempts were once more made to drain them, and, as it appears, not without success. But the operations were not long persevered in, and hostile nature soon resumed her rights. Among the popes, Boniface VIII. (who died in 1303) was the first who occupied himself with the draining of the marshes; and he caused a large canal to be dug, by means of which the country around Sezze and Sermonetta remains dry even to this day. Martin V., in 1417, likewise caused a great canal, the Rio Martino, to be dug, for the extension of which to the sea hardly a mile was wanting, when this undertaking, which would have supplied an outlet for all the streams, was interrupted by his death. Other attempts were subsequently made, though with little success, till Pius VI. engaged in the undertaking. This pontiff spent ten years—from 1778 to 1788—in systematic efforts for reclaiming the marshes. Canals, among them the Linea Pia, were cut, the beds of the different streams, the slime of which filled the air with unwholesome vapours, were cleansed, and the line of the Appian Way, which had been abandoned for centuries, was restored. By these means the submerged part, which had previously reached about 50,000 acres, was reduced to 5000. The administration of the first empire laboured in like manner at the draining of the marshes, from 1810 to 1814, when the operations were stopped through the fall of Napoleon. But notwithstanding all these labours, now completely abandoned, the air of this region is far from being salubrious, and the vast tract is little else than a wretched desert, where one meets nothing but a few abandoned houses, and which the traveller seeks to leave behind him as fast as he is able.

PONTOISE, a town in France, in the department of Seine-et-Oise, at the confluence of the Viosne with the Oise, here crossed by a handsome bridge, 19 miles north of Versailles. The houses are tolerably well built, but most of the streets are narrow and steep. Its chief edifices are the church of St. Maclou, the public library, and a magnificent hospital. It has a court of first resort, and a college; manufactures of chemical products, and a trade in corn, cattle, and flour. Pop. (1881), 6412.

PONTOON, in war, denotes a small, light vessel, made generally of wood, sheet-iron, or leather, and so constructed that when a number of them are united by means of beams, boards, and ropes they form a bridge for the passage of an army over a river or arm of the sea. As pontoons form a part of the equipment of an army they must be as light in structure as is consistent with safety. Those in use on the Continent are of a flat-bottomed boat shape, and made of wood or sheet-iron. The pontoons used in the British army are of tin, and cylindrical in shape. They are of two sizes, the larger, with hemispherical ends, being 22 feet 3 inches long and 2 feet 8 inches in diameter, and the smaller one, with conical ends, 14 feet 9 inches long and 1 foot 7 inches in diameter. The introduction of pontoons proper into warfare may be considered to date from the eighteenth century, although long previous to this similar means were used for the passage of streams. Darius passed the Hellespont and Danube by pontoon bridges. Xerxes likewise made the passage of the Hellespont with his vast army by similar means.

PONTOPPIDAN, Eric, the younger, born at Aarhuus 24th August, 1698; died 20th December, 1764. After acting as pastor at different places in Schleswig and Seeland he became preacher to the court in 1735, and soon after professor of theology in Copenhagen, in 1747 Bishop of Bergen, and in 1755 chancellor of the University of Copenhagen. As a theologian he favoured the pietism of Spener, and some of his works on this system of doctrine, especially his Helle Glaubenspiegel, are still in the hands of the people. His Menoza (three vols. 1742), one of the first theological romances, is especially valuable on the account of its attractive characterization of some of his celebrated contemporaries. His works on church history, such as his Annales Ecclesiæ Daniæ (four vols. Copenhagen, 1741–52), contain a great mass of valuable materials. He also enriched history in general by his Marmora Danica (two vols. 1739–41), Gesta et Vestigia Danorum extra Daniam (three vols. Leipzig, 1740–41), Origines Hafnienses (1740), and his Danske Atlas (seven vols. Copenhagen, 1763–81). His learning was very comprehensive; for instance, his Glossarium Norvagicum (Bergen, 1749) was a valuable contribution to the science of language, as was his Forsög til Norges naturlige Historie (Copenhagen, 1752–54; Essay on the Natural History of Norway, translated into English, London, 1755) to natural history.

PONTUS, in Asia Minor (so called from the Pontus Euxinus, on which it lay), the country extending from the Halys to Colchis. Its limits underwent at first considerable changes, and when finally fixed it bordered in the west on Paphlagonia, where the Halys formed the boundary; in the south on Galatia, Cappadocia, and Armenia Minor, the Antitaurus, and Mount Paryadres being the boundaries; and in the east on Colchis and Armenia, from which it was separated by the river Phasis. The country on the east and south is mountainous, but along the coast there are large and fertile plains. According to Strabo great varieties of excellent fruit were produced, and game abounded. The oldest inhabitants were Tibarenes and Chalybes. A son of the Persian king Darius, Artabazes, received Pontus as a separate satrapy, with the right to transmit it as an inheritance to his posterity. One of his successors, Mithridates (about 400 B.C.), assisted the younger Cyrus, and refused to pay tribute to Artaxerxes. His son, Ariobarzanes I. (363–337), made himself independent during the general insurrection of the governors of Asia Minor against Artaxerxes II. Mithridates II. (337–302) transferred his kingdom voluntarily to Alexander. Afterwards, in the division of his empire in 322, it fell to Antigonus, who, having attempted the death of Mithridates, the latter fled to Paphlagonia, where he found adherents, and successfully maintained himself. His successor, Mithridates III. (302–266), enlarged his paternal kingdom by conquests. Mithridates III. was succeeded by his son Ariobarzanes III., who reigned from 266 to about 240 B.C., and he again by his son Mithridates IV., whose reign extended to about 190 B.C. The latter drove back the Gauls, who at various

times in the course of the third century B.C. invaded Asia Minor, and formed settlements there, and who made an attack upon Pontus shortly after the accession of Mithridates IV. He also attacked Sinope, but was unable to take it. Pharnaces I., who succeeded Mithridates IV., and reigned till about 156 B.C., at length took possession of Sinope, and made it his residence. Mithridates Euergetes, father of the celebrated Mithridates, aided the Romans in the third Punic and in the Pergamian war, and received from them Phrygia Major. He was murdered about 124. His son, Mithridates the Great, succeeded him. During his reign the territory of Pontus was increased by the addition of the Cimmerian Bosporus, a small kingdom nearly corresponding to the modern Crimea, which the last king voluntarily ceded to Mithridates. But it was during the same reign that the kingdom of Pontus itself came to an end. Mithridates carried on bloody wars with Rome until his death; at last he submitted to Pompey, and killed himself, B.C. 63, from despair. The western part of Pontus was then annexed to Bithynia, and the remaining parts given away to the chiefs of some of the adjoining states. Pharnaces II., the treacherous son of Mithridates, obtained only Bosporus, and when he attempted to conquer again his paternal kingdom was vanquished by Cæsar, and put to death by Asander, who had made himself King of Bosporus. Still his son Darius received through Antony a part of Pontus. Polemon, who at the same time possessed the Kingdom of Bosporus, Asia Minor, and Colchis, was his successor. After the death of his widow, Pythodoris, Polemon II. succeeded, as King of Pontus, A.D. 39. Nero took Bosporus from him, and Pontus, under the name of Pontus Polemoniacus, became, after Polemon's death, a Roman province. When the Latins in 1204 again conquered Constantinople Alexius Comnenus founded a new kingdom in Pontus, which remained until Mohammed II. united it in 1461 with his great conquests.

PONTUS EUXINUS, the ancient name for the Black Sea (which see). According to some its Greek name *Euxeinos pontos* (signifying *hospitable sea*) was given it on account of its beautiful scenery and fruitful coasts; according to others it was at first called *Axeinos* (inhospitable) on account of the barbarous character of the inhabitants along its shores; but as these were softened by commercial intercourse its name was changed to *Euxinus*.

PONTYPOOL, a market town, England, in the county and 15½ miles south-west of Monmouth, on a branch of the South Wales Railway. It is irregularly built, has an Episcopal chapel, and places of worship for Baptists, Wesleyans, Independents, Friends, and Roman Catholics; a town-hall, a stone building in the Italian style; a Baptist theological college, &c. The manufacture of varnished iron articles known as Pontypool Japan ware, once carried on here extensively, is now extinct, and the greater portion of the population is employed in iron-works and forges and iron-mills for making tin-plate. There is a considerable trade here in iron and coal. Pop. in 1881, 5244.

PONY, a term applied to several sub-varieties or races of Horses, generally of smaller size than the ordinary horses, and which are bred in large flocks and herds in various parts of the world, chiefly for purposes of riding and of lighter draught work. Ponies may be said to unite in themselves the beauty, strength, and hardiness of their larger neighbours. Of the breeds of Ponies the best known and most valued are the Welsh and Shetland. The head of the Welsh pony is small, the withers high, the body rounded and deep, the legs flat, and the hoofs and ears small. The Shetland pony is generally smaller than the Welsh, the shoulders being thick and low, and the limbs very stout and powerful. Other breeds come from Iceland, Exmoor, the New Forest, and the Scotch Highlands. The Galloway Horses of Scotland were a breed of very strong hardy ponies, sometimes attaining a height of 14½ hands.

POODLE, a well-known species of dog, originally German, but now abundant in all parts of Europe. There are two varieties, but the only difference between these is in point of size, the one being larger than the other. The body of the poodle is thick and short; the head large and round; the ears long and pendent; the tail somewhat short; the hair long, curled all over the body, and generally of a black colour or spotted black and white, sometimes it is all white. Of all dogs the poodle is the one whose intelligence seems most susceptible of development, and which exhibits most affection for its master. Its scent is good; it is fond of the water, and swims with great ease, which causes it to be frequently employed in hunting aquatic birds. It is very easily trained.

POOLE, a seaport and municipal and parliamentary borough of England, in the county of Dorset, in the north part of Poole Harbour, and on a branch of the London and South-Western Railway. It is a very ancient place, with many burrows and other early antiquities in its vicinity; had fortifications, which were demolished in the time of Charles II. The old town is being surrounded by handsome suburbs at a rapid rate. Among the buildings are an elegant modern parish church, several Dissenting chapels, a town-hall, guildhall, the wool-house, and custom-house. The manufactures consist chiefly of cordage and sail-cloth; there are also potteries, large flour-mills, and two iron-foundries. The harbour is large and commodious, with excellent quays and extensive warehouses; and there are several large building-yards, and a valuable plaice and herring fishery. The shipping trade is considerable; in 1882 the number of vessels that entered was 945 of 76,547 tons; cleared, 949 of 78,289 tons. The chief exports are clay for the Staffordshire potteries, and manufactured clay goods. Poole returns one member to Parliament. Pop. in 1881, 12,310.

POOLE, MATTHEW, the well-known compiler of the Synopsis Criticorum Biblicorum, was born at York of a good family about 1624, studied at Emmanuel College, Cambridge, and took orders. In 1662 he was ejected by the Act of Uniformity from his church of St. Michael-le-Querne in London, and turned his leisure to good account by spending ten years on his Synopsis, which is an attempt to condense into one work the opinions of all the biblical critics of all times and countries previous to his own. The work extended to five large folio volumes, and indicates great labour and research as well as no small degree of learning; but it is now of little use, later criticism and research having done much to supersede it. Poole also wrote Annotations on Scripture, and took an active part in the leading controversies of his time, especially those with the Socinians and Roman Catholics. The intolerant spirit of the Stuarts compelled him to seek an asylum at Amsterdam, where he died in 1679.

POONAH, or PUNA, a city and district of Hindustan, in the presidency of Bombay. The city, in a plain about 2000 feet above the sea, 119 miles eastward from Bombay by the Great Indian Peninsula Railway, stands at the junction of two affluents of the Bhima River, and wears a somewhat European aspect. It is pretty well built; its main street is wide, and lined with buildings ornamented with paintings and mythological carvings; it has numerous pagodas, a Hindu college, an engineering

college built in 1868, a female normal school, a government first grade high school, a British church, council hall, public library, civil hospital, arsenal, and barracks for two regiments of infantry and one of cavalry. The European cantonments are on the east, and separated from the city by a line of bazaars; and on the south-west is the ruined palace of the Peishwa or head of the Mahratta confederacy, whose capital was Poonah. This station is famed for salubrity, and is resorted to by most of the European officers of Bombay during the rainy season. It is an important military post, and has some manufactures of silver and gold jewelry, combs, dice, and other small articles of ivory, silk and cotton fabrics, and articles of brass, copper, iron, and clay. Around it are numerous ruined hill forts on isolated peaks; and good roads connect it with Bombay, Ahmednagar, Sattarah, &c. Large and important works supply Poonah and Kirki with water from the Mula Valley, 10 miles above Poonah. The annual rain-fall averages 22 to 25 inches, being about a fourth of the average fall at Bombay. Pop. (1881), 129,751.—The district, lat. 16° 30′ to 19° N.; lon. 73° 30′ to 76° E., is bounded on the north by the district of Ahmednagar, west by the Ghauts, separating it from the Concan, south by Sattarah, and east by the Nizam's Dominions. Area, 5348 square miles. It is an elevated tableland, watered by the Bhima and its tributaries, and abounding in isolated heights, formerly crowned with strong fortresses. The villages are mostly open, but sometimes surrounded by hedges of cactus. Inhabitants chiefly Mahrattas. After Poonah the principal towns are Serur, Paidgaon, Solapur. Pop. (1881), 900,621.

POONA WOOD is the wood of the poon tree (*Calophyllum inophyllum* and *Calophyllum angustifolium*), a native of India. It is of a light, porous texture, and is much used in the East Indies in shipbuilding for planks and spars. The Calcutta poon is preferred to that of other districts.

POOP (Latin, *puppis*), the aftermost and highest part of the hull in large vessels; also a deck raised over the after-part of a spar-deck, sometimes called the *round-house*. Ships formerly had several poops, the one above the other. The tendency now is to dispense with the poop altogether on account of the obstruction it presents to the ship's progress through catching the wind.

POOR AND POOR'S LAWS. Poor, in the special sense in which we take it here, is a term used in reference to one who lacks the means necessary for his subsistence. At no period in the whole history of the world, and amongst no people, can there be said to have existed no poor. So long as a man is liable to become dependent on others for the means of his subsistence, so long is he liable to poverty. The history of pauperism presents us with much that is interesting. In Egypt, where the system of caste, which was afterwards so fully developed in India, originated, the lower classes, as far back as history takes us, were doomed to poverty, while luxury and profusion were reserved for the priests and warriors, who constituted the upper classes. The famine which arose under the eighteenth dynasty obliged the Egyptians to sell their persons or their labour to the kings, by whom they were treated as mere machines. Babylon and Nineveh present us with a similar spectacle; enormous wealth amongst the great, and penury and servitude amongst the humbler classes. In Persia the people, according to Herodotus, were distributed into ten tribes, and the three lowest of these were in a state of poverty. Greece presents us with the aspect of a small number of citizens with an enormous number of slaves. But even amongst the citizens poverty and misery must have existed to a great extent; for although the historians are reticent upon this point, there is little doubt that this was one of the main causes of such frequent emigrations, resulting in the establishment of many colonies along the Italian and Asiatic shores and elsewhere, as also for the law that in Sparta permitted the poor to expose their infants. In Rome, in its earlier days at least, the contest between the plebeians and the patricians partook very much of the nature of a struggle between poverty and riches. Surrounded by enemies, and almost constantly engaged in warfare, which subjected the cultivators of the soil to have their lands and houses frequently pillaged, and the fruit of their labours all destroyed, many were plunged into abject poverty, and the severe laws regarding debtors only served to increase their misery. Only the patricians, as a rule, were able to lend money, and thus the contest between debtors and creditors was in its origin identical with that between the plebeians and the patricians. As Rome extended, the gulf between the poor and the rich became still wider, notwithstanding the agrarian laws enacted with a view to remedy this evil. The unsettled state of the country following the downfall of the Roman Empire must have been the occasion of an incalculable amount of misery. In 994 the plague desolated the centre of France. In 997 the starving peasantry rose in rebellion against the nobles. From 1030 to 1033 thousands were cut off by famine. During the middle ages the great majority of the people were in a state of bondage to their feudal superiors, who, however, were obliged to attend to the maintenance of the serfs, and many freemen, in order to avoid destitution, surrendered their liberty and became serfs.

In all the countries of modern Europe laws have been enacted relative to the maintenance of the poor; but in this article we shall confine ourselves to British legislation on the subject. The poor recognized by the law are the poor by impotency and defect; the poor by casualty; and the poor by prodigality and debauchery, also termed the thriftless poor. In England, up to the time of Henry VIII., as also in all the continental countries, the poor subsisted entirely on private benevolence, one of their chief resources being the monasteries. But the charity exercised by these institutions, however commendable in certain respects, had the radical defect of encouraging rather than repressing mendicity, and when the institutions themselves were swept away by the reforming measures of Henry VIII., thousands of these poor dependent upon them were thrown upon the country at large for their subsistence. Numerous statutes were passed in the reign of Henry VIII. and following reigns to provide for the poor and impotent, who appear from the preambles of some of these to have increased at that time to a very considerable extent. These poor were principally of two classes: the sick and infirm, who were unable to work; and the idle and sturdy, who did not choose to work. To provide in some measure for both of these in and about the metropolis, Edward VI. founded three royal hospitals; Christ's and St. Thomas' for the relief of the impotent; and Bridewell for the punishment and employment of the vigorous and idle. But these were far from sufficient to meet the requirements of the kingdom at large. Accordingly other measures were adopted, and after a number of fruitless experiments 43 Eliz. cap. ii. (1601) provided for the appointment in every parish of overseers of the poor, whose chief duties were: first, to raise competent sums for the necessary relief of the poor, impotent, old, blind, and others who were poor and not able to work, and them

only; and, secondly, to provide work for such as were able and could not otherwise find employment. For these purposes they had power to levy rates upon the inhabitants of the parish. The overseers were appointed, three or four for each parish, from amongst the householders, by the justices, and they had to act in conjunction with the churchwardens. This act of Elizabeth, which is the basis of the poor-law system of England, came into operation very slowly.

The troubles of 1640, and the civil war that followed them, necessitated an extensive application of the law. One of the first acts of Charles II. after his restoration was to pass a law in 1662 modifying the statute of 1601, so far as the limits of its application was concerned. As before, each parish formed a single district, but as the extent of the parishes were so various, the justices of the peace were authorized to appoint inspectors for sections of parishes, as townships, villages, and hamlets. From this period till 1834 the administration of relief was intrusted to the churchwardens and inspectors. In 1782 Parliament passed a law known as *Gilbert's Act*, authorizing the voluntary union of several adjacent parishes to found and support a *poor-house* for the reception of those poor who required permanent succour, and their control was intrusted to *guardians* appointed for that purpose, as well as for the administration of out-door relief. The working of these laws was attended with numerous abuses, arising in great part from the absence of any fixed rule by which the overseers and churchwardens might be guided. The poor-rate pressed so heavily, and the execution of the laws regarding it had caused so much inconvenience, that in some parishes tillage had to be abandoned, and the neighbouring parishes were, in consequence, charged with the maintenance of the poor of these, in addition to their own. This state of matters threatened an alarming increase of pauperism. From March, 1832, to March, 1833, the tax for the relief of the poor had risen to close upon £7,000,000 for a population of 13,894,574 inhabitants. A commission was appointed to inquire into these abuses, and the result was the Poor Law Amendment Act of 1834, which, along with some more recent statutes, particularly those of 1844 and 1857, forms the legislation in actual operation at the present day.

Two important reforms were introduced by the act of 1834: the collection and distribution of the rates are no longer intrusted exclusively to the parish authorities. Each locality forms an aggregation of a number of parishes called a *union*. Each union is under a committee of supervision, composed of guardians named by the ratepayers. This committee is charged with fixing the amount of the contributions, and with ordaining and directing the distribution of relief in the unions. The general direction of the whole system was by this act placed in the hands of three commissioners, appointed, paid, and removable by the crown. These were authorized to make rules for the management of the poor, the government of workhouses, the conduct of guardians, vestries, and officers; the keeping of accounts, making of contracts, and all other matters relating to the relief of the poor. This commission was superseded in 1847 by the poor-law board, under 10 and 11 Victoria, cap. cix., and to this new board of commissioners, perpetuated by various subsequent acts, were transferred all the powers and duties of the former commissioners. The other reform introduced by the law of 1834 was the refusal of all succour to the able-bodied poor, except in workhouses established on a very rigorous basis, the principle being that no one who obtained parochial relief should be better provided for than the commonest labourer. The poor-law board consisted of a president and four commissioners—namely, the lord-president of the council, lord privy-seal, home secretary, and chancellor of the exchequer, and such other as the queen by letters-patent or commission might appoint. A report of the proceedings of the board was to be submitted to Parliament each year.

Further legislation on the subject has again taken place, and by the Local Government Board Act, 1871, it is enacted—proceeding on the preamble that it is expedient to concentrate in one department of the government the supervision of the laws relating to the public health, the relief of the poor, and local government—that a board shall be established, to be called the Local Government Board, and from and after the establishment of such board the poor-law board shall cease to exist, and all powers and duties vested in or imposed on the poor-law board by the several acts of Parliament relating to the relief of the poor, and any other acts, or vested in or imposed on one of her majesty's principal secretaries of state, by the enactments in that behalf mentioned in the first part of the schedule annexed to the act, so far as such powers and duties relate to England; or vested in or imposed on her majesty's most honourable privy-council by the enactments in that behalf specified in the second part of the said schedule, shall be transferred to, and imposed on, the said local government board, and except as otherwise provided by the act, shall be exercised and performed by such board in like manner and form, and subject to the same conditions, liabilities, and incidents respectively as such powers and duties might, before the passing of the act, have been exercised and performed by the authorities, in whom the same were then vested respectively, or as near thereto as circumstances admit. The local government board, in terms of this act, shall consist of a president to be appointed by her majesty, and of the following *ex officio* members, that is to say, the lord-president of her majesty's most honourable privy-council, all her majesty's principal secretaries of state for the time being, the lord privy-seal, and the chancellor of the exchequer. The duty of making and levying the poor-rate still belongs, as before the changes introduced by this act, to the churchwardens and overseers; and the concurrence of the inhabitants is not necessary. But the appointment of collectors and assistant-overseers for the better carrying out of these objects is authorized by the recent acts. The rate is levied in advance for a part of the year on a scale adapted to the probable exigencies of the parish; and the act of Elizabeth directs that it should be raised by 'taxation of every inhabitant, parson, vicar, and other, and of every occupier of lands, houses, tithes impropriate, propriations of tithes, coal mines, or saleable underwoods in the parish.' As an occupier a man is rateable for all lands which he occupies in the parish, whether he is resident or not; but the tenant and not the landlord is considered as the occupier within this statute.

After the passing of the act of 1834 unions were rapidly formed in the southern, eastern, and central parts of England, where the abuses of the previous régime had been most keenly felt; but in the northern and manufacturing districts the measure was very unfavourably received, and led to much disorder. The commissioners, however, notwithstanding these discouragements, continued their work, and now, with few exceptions, and these few fast disappearing, these unions have become universal all over England. The relief afforded to the poor since 1834 is of two kinds; *in-door* and *out-door*, the former given in the workhouse, and the latter in the pauper's own dwelling. Out-door relief is more

especially accorded to children, the aged, and invalids, but in certain cases it is also accorded to the able-bodied. With regard to the law of settlement in a parish in reference to parochial relief, see SETTLEMENT. The poor-rate defrays not only the assistance bestowed on paupers, but a certain number of other expenses; expenses of police, maintenance of roads, &c. As regards the relief of the poor alone, the total expense doubled itself in the thirty-five years from 1837 to 1872. The total number of paupers in England and Wales on the 1st of January, 1883 was 799,296, showing an increase of 1682 over the preceding year.

In the law of Scotland two kinds of poor are recognized, the *idle* and the *infirm*. With regard to the former several acts have been passed for the punishment of sturdy beggars and vagabonds. According to some of these the punishment ordained to be inflicted was of a very severe character, as whipping and burning in the ear; and by Act 1579, cap. lxxiv., a repetition of the crime was made punishable with death. But, except as to some minor penalties kept up against vagabonds, these statutes have fallen into total disuse. With regard to the infirm poor, that is those who from age and other infirmities are unable to maintain themselves, Act 1535, cap. xxii., ordained their maintenance by a tax levied on the parish; and by an Act 1663, cap. xvi., power was given to the landholders in landward parishes to assess themselves for the maintenance of such of the poor as cannot fully maintain themselves, the half of which assessment they were entitled to exact from the tenant. Other acts were subsequently passed for the better administration of previous acts. The act by which the relief of the poor is now administered, is 8 and 9 Vict. c. lxxxiii. (amended by 24 and 25 Vict. c. xviii.). A general board of supervision is established, and assessments are imposed by the parochial boards of the respective parishes, in accordance with one or other of the three modes authorized by the statute. By one mode one-half of the assessment is imposed upon the owner, and the other half upon the tenants or occupants of all lands and heritages within the parish, according to the annual value of these. By another mode, one-half of the assessment is imposed upon the owners of the lands and heritages in the parish, and the other half is imposed upon the whole inhabitants of the parish, according to their means and substance other than lands and heritages situated in Great Britain or Ireland. By a third mode of assessment, the assessment is imposed as an equal percentage upon the annual value of all lands and heritages within the parish, and upon the estimated annual income of the whole inhabitants of the parish from means and substance other than lands and heritages situated in Great Britain or Ireland. It is in the power of the parochial board to adopt any one of these three modes of assessment, subject, however, to the approval and ratification of the board of supervision. The property formerly vested in the heritors and kirk-session, for behoof of the poor of a parish, is now administered by the parochial board of the parish; but church collections continue to be disposed of by the kirk-session of each parish in the same manner as formerly. The relief is administered by the parochial board, which is appointed by the ratepayers, the burgh magistrates, and the kirk-session, and is accorded to the occasional as well as to the permanent poor. Unlike the law as administered in England, able-bodied persons out of employment have no right to demand relief. The relieving officers are the inspectors appointed by the board. The parish in which a man has been born is the one which is bound to support him, unless he has formed a new settlement for himself by residence. A residence of five years in any parish constitutes a settlement there. The number of registered paupers and their dependants on the 14th May, 1877, was 96,404, a number lower than that of any previous year; in 1878 at the same period it was still lower, being then 94,671. This decrease in pauperism is doubtless due to a considerable extent to the general prosperity of the country, but it also arises in no small degree from a more careful distribution of relief. In 1880 there was a slight increase, the number being 98,608; while in 1882 the number was 95,081.

In Ireland there were no poor-laws till 1838. By 1 and 2 Vict. cap. lvi. passed in that year, Ireland is divided, for the purposes of poor-relief, into 163 unions of town-lands or parishes. Each union has a workhouse, managed by a board of guardians elected by the ratepayers. Every destitute person has an absolute right to relief, which is administered almost entirely in the workhouse. In the first week of January, 1883, the total number of paupers in receipt of relief in unions in Ireland was 115,684.

The following is a statement of the total expenditure for the relief of the poor (including cost of management) in England and Wales, Scotland, and Ireland, for the five years ending 1882:—

	England.	Scotland.	Ireland.	Total.
1878....	£7,688,650....	£918,790....	£845,608....	£9,453,048
1879....	7,829,819....	922,643....	847,955....	9,600,417
1880....	8,015,010....	931,144....	929,967....	9,876,121
1881....	8,102,136....	951,122....	965,128....	9,918,386
1882....	8,232,472....	912,536....	967,483....	10,112,491

For the ten years ending 1883 there has been a slight decrease in the number of paupers in England, a much more marked decrease in Scotland; on the other hand Ireland's pauper roll shows a steady and considerable increase.

There are special acts of Parliament regulating the removal of paupers from any one of the three divisions of the United Kingdom—England, Scotland, and Ireland—to any other of these.

POOR'S RATE is the name given in Britain to the taxes raised for the aid or support of those who cannot support themselves. See POOR AND POOR'S LAWS.

POOR'S ROLL, in the law of Scotland, is the list of litigants who, by reason of poverty, have the privilege of suing or defending a case in court *in forma pauperis*, by which they are exempted from the payment of any court fees, and are entitled to have their case conducted gratuitously by the counsel and agents for the poor. The privilege of poor's roll is only accorded to an applicant on his producing a certificate signed by the minister and two elders of the parish in which he resides, setting forth his circumstances, according to a formula annexed to the act. The formula states the applicant's age, whether he (or she) be married or not, the number of his children, the length of his residence in the parish, the property of which he is possessed, his trade and earnings, and whether he have any other lawsuit. The adverse party in the suit must be apprised ten days previously of the time and place fixed for making the declaration or statement of these particulars before the minister and elders, in order to give him time to oppose the application for a certificate; and evidence of the intimation must be produced to the minister, under the hands of some officer of the law. After he is furnished with the certificate obtained in the manner stated, the applicant is warranted in petitioning the court for the benefit of the poor's roll. After the petition is received by the court it is remitted to the counsel for the poor, to report whether the petitioner has a *probabilis causa litigandi*, that is, a good cause of action. Two advocates are appointed each year to act exclusively as reporters on the *probabilis*

causa litigandi of applicants, and if their report be favourable the case is then remitted by the court to the counsel and agent who have thus reported, to be conducted by them. The period for which the warrant for the benefit of the poor's roll remains in force never exceeds two years; but a renewed application is allowed to be made. There is no provision for litigation corresponding to that of the poor's roll either in England or Ireland.

POPAYAN, a city of Colombia, in a fertile plain watered by the Cauca, and near the volcanoes Puracé and Sotaro, 228 miles south-west of Bogota. It is regularly built, has fine streets, and although greatly declined from its former magnificence, is still one of the principal cities of the republic. It is the seat of a bishopric, has a university, a college, an hospital, and other public institutions. Its trade is now chiefly confined to agricultural produce. It was founded in 1536, and almost completely destroyed by an earthquake in 1834. Pop. about 8500, though at one time above 20,000.

POPE, ALEXANDER, a celebrated English poet, was born May 22, 1688, in Lombard Street, London, where his father, a linen-draper, acquired a considerable fortune. Both his parents were Roman Catholics. Soon after the birth of his son, who was of very delicate constitution, small, and much deformed, the father of Pope retired from business to a small house at Binfield, near Windsor Forest. The young poet was taught to read and write at home, and at the age of eight was placed under the care of a Catholic priest, named Taverner, from whom he learned the rudiments of Latin and Greek. Being fond of reading he became acquainted at this early period with Ogilby's version of Homer, and Sandys' translation of Ovid's Metamorphoses, which books first turned his attention to poetry. He was successively placed at two other schools, the first at Twyford and the second at Hyde Park Corner, where he formed a play taken from Ogilby's Homer, intermixed with verses of his own, and had it acted by his schoolfellows. About his twelfth year he was taken home and privately instructed by another priest; and to this period is assigned his earliest printed poem, the Ode on Solitude. He subsequently appears to have been the director of his own studies, in which the cultivation of poetry occupied his chief attention. He particularly exercised himself in imitation and translation, of which his versions of the first book of the Thebais and of the Sappho to Phaon, made at the age of fourteen, afford a remarkable testimony. He was sixteen when he wrote his Pastorals, which procured him the notice of several eminent persons. His Ode for St. Cecilia's Day and Essay on Criticism were his next performances of note, the latter of which was written in 1709, and published in 1711. He became embroiled with Ambrose Philips in consequence of an ironical comparison of that writer's pastorals with his own in the Guardian, and with the irascible critic John Dennis, owing to a humorous allusion to him under the name of Appius, in the Essay on Criticism. The Elegy on an Unfortunate Lady, which appeared in 1711, was followed by the Rape of the Lock, grounded on a trifling incident in fashionable life. In this production the poet displays admirable vivacity and the most polished wit, but its imaginative power is chiefly conspicuous in the exquisite machinery of the sylphs, wrought into it as an afterthought, for the poem first appeared without it. He next published the Temple of Fame, altered and modernized from Chaucer, which was followed in 1713 by his Windsor Forest, commenced at sixteen. In the same year he published proposals for a translation of the Iliad, by subscription, which were received with great encouragement; and the first volume, containing four books, appeared in 1715 (in 4to). An open breach with Addison preceded this publication, owing to an alleged jealousy on the part of the latter, to whom a rival translation of Homer, published under the name of Tickell, was attributed by Pope. Whether by Addison or Tickell, the rival version soon sank before that of Pope, who was enabled by the great success of his undertaking to take a handsome house at Twickenham, to which he removed with his father and mother. About this time he wrote his impassioned Epistle from Eloisa to Abelard, one of the most vivid and impressive of all amatory poems. In 1717 he republished his poetry in a quarto volume, to which he prefixed an elegant preface, and in 1720 completed the Iliad. In 1721 he undertook the editorship of Shakspere's works—a task for which he was wholly unfit; and a severe castigation from Theobald laid the foundation of a lasting enmity between them. With the assistance of Broome and Fenton he also accomplished a translation of the Odyssey, the subscription to which brought him a considerable sum. In the meantime he had formed a friendship with Martha Blount, the daughter of a Catholic gentleman near Reading, who became his intimate *confidante* and companion through life. A sort of literary flirtation also commenced with the celebrated Lady Mary Wortley Montagu, which, after much intercourse and correspondence, terminated (see MONTAGU—LADY MARY WORTLEY) in the bitterest enmity. In 1727 he joined Swift in a publication of Miscellanies, in which he inserted a treatise Of the Bathos, or Art of Sinking, illustrated by examples from the inferior poets of the day. In 1728 he sent out the three first books of his Dunciad, a mock-heroic poem, the object of which was to overwhelm his antagonists with ridicule. It is a finished example of diction and versification, but displays much irritability, illiberality, and injustice. Personal satire, to which he was first encouraged by Bishop Atterbury, appears in most of his subsequent productions. Being particularly connected with the Tory party he had become intimate with Lord Bolingbroke, to whose suggestion the world is indebted for the Essay on Man, first published anonymously in 1733, and the next year completed and avowed by the author. This work is more distinguished by its poetry than its ethics. It was followed by Imitations of Horace, accompanied by a Prologue and Epilogue to the Satires, and by Moral Epistles or Essays, which exhibit him as a satirist of the school of Boileau, with more spirit and poetry and equal causticity. The persons whom in these works he treats with most severity are Lady Mary W. Montagu and Lord Hervey. Curll, the bookseller, having published some letters written by Pope, the latter affected great anger; yet there is some evidence to countenance the notion that he contrived the plot himself, in order to form an excuse for the publication of a quarto volume of letters, in his own name, for which he took subscriptions. They are elegant and sprightly, although studied and artificial; but as many characteristic epistles are given from those of his correspondents, the collection is interesting and valuable. In 1742, at the suggestion of Warburton he added a fourth book to his Dunciad, intended to ridicule useless and frivolous studies, in which he attacked Colley Cibber, then poet-laureate. Cibber retaliated by a pamphlet, which told some ludicrous stories of his antagonist, and so irritated the latter that, in a new edition of the Dunciad, he deposed Theobald, its original hero, and promoted Cibber in his place, who, although a great coxcomb, could scarcely be deemed a dunce.—An oppressive asthma began now to indicate a commencing decline, and in this state of debility he was consoled by the affectionate attention of his friends,

and particularly of Lord Bolingbroke. When the last scene was approaching he allowed one of his intimates, the historian Hooke, himself a Catholic, to send for a priest, not as essential, but becoming; and soon after quietly expired, May 30, 1744, at the age of fifty-six. He was interred at Twickenham, where a monument was erected to him by Bishop Warburton, his legatee.

Both the moral and poetical character of Pope have been assailed and defended with peculiar animation. Vain and irascible he seems to have been equally open to flattery and prone to resentment; but one of his greatest weaknesses was a disposition to artifice in order to acquire reputation and applause, which is justly deemed indicative of littleness of mind. He was not, however, incapable of generous and elevated sentiments, and was as firm in his attachments as implacable in his dislikes. He had always a dignified regard to his independence, which in one to whom money, high connections, and the superfluities of life, more especially the luxuries of the table, were by no means indifferent, is the more remarkable. He has been accused of meanness towards his literary coadjutors, but certain stories of a nature to impeach his integrity are now no longer believed, especially as something like an indisposition to do him justice, either as a poet or a man, has been manifest in those who related them. As a poet, while his claim to invention is bounded, the endeavour to set him aside altogether, in compliment to certain metaphysical distinctions in regard to the primary sources of poetic feeling, is factitious and futile. No English writer has carried further correctness of versification, splendour of diction, and the truly poetical art of vivifying and adorning every subject that he touched. His Rape of the Lock, and Epistle from Eloisa to Abelard, are alone sufficient to impeach the exclusive theory which would deny him the rank and powers of a poet, leaving his wit, his brilliancy, and his satire to be ranked as they may be. Of the various editions of Pope's works it is only necessary to mention those of Warburton, Johnson, Warton, and Bowles (the last in ten vols. 8vo, 1806), together with the new and as yet (1884) uncompleted edition by the Rev. W. Elwin, containing about 300 letters previously unpublished.

POPES. *Pope* (Greek, *pappas*, father) is the title given to the head of the Roman Catholic hierarchy; it is also applied by the eastern Christians to all priests, and in early times was given in the West to all bishops, until subsequently it was restricted to the Bishop of Rome. During the apostolic age, and for more than a century afterwards, the Christian churches were in entire independence, so far as their government was concerned, of each other. Each church had its presbyters or bishops—for these were convertible terms—and its deacons, and upon these functionaries devolved the spiritual charge of the congregation. But gradually this state of matters changed, and gave place to the episcopal form of government. One of their number was elected to preside over the college of presbyters, and to him was given the special title of bishop. Though at first regarded only as first among his equals, the bishop soon claimed authority over his co-presbyters. The custom of holding provincial synods began to prevail towards the end of the second century. These assemblies consisted of the bishops of the independent churches, with a few presbyters and deacons. 'A regular correspondence,' says Gibbon, 'was established between the provincial councils, which mutually communicated and approved their respective proceedings; and the Catholic Church soon assumed the form and acquired the strength of a great federative republic.' The bishops of the third century imperceptibly substituted for the language of exhortation that of command. They were the vicegerents of Christ, the successors of the apostles, and the mystic substitutes of the high-priest of the Mosaic law. As formerly among the presbyters, so now among the bishops, some acquired pre-eminence over the others. The pre-eminence in councils was accorded to the metropolitans, or the bishops of the chief cities of the provinces, and next arose a struggle amongst the metropolitans themselves for the pre-eminence. From various causes, but more especially from the circumstance that Rome was the ancient capital of the empire, and, according to tradition, the scene of the latest labours of St. Peter, it was easy to foresee that the bishop of that city, the alleged successor of Peter, would obtain the respect, and soon claim the obedience, of the provinces. To Rome disputants appealed for ultimate decision, and oppressed parties for advocacy and protection. Thus Rome gradually rose in authority, and soon claimed, as of right, what at first personal confidence or the urgency of circumstances had accorded in special and individual instances. From the end of the fourth century the Bishop of Rome was the first among the five patriarchs, or superior bishops of Christendom; but he did not at first possess any peculiar jurisdiction over provincial dioceses. A provincial synod at Sardica in Illyria in the year 347, and a decree of the Emperor Valentinian III. in 445, had indeed acknowledged the Bishop of Rome as primate, and as the last tribunal of appeal from the other bishops; but even in the West, where alone these edicts had the force of law, the measures of the popes, until the eighth century, often met with violent opposition. At first the claim to the primacy on the part of the Roman see was based only on human authority. Leo the Great (440–461) was the first, in his instructions to his legates at the Council of Ephesus, held in 449, to rest it on divine authority, by appealing to Matt. xvi. 18: 'Thou art Peter, and upon this rock will I build my church;' which had formerly been interpreted, following Cyprian, as applying to all the apostles, and hence to all bishops. The Eastern Church always resisted the claims of the see of Rome to the primacy, and this it was which mainly occasioned the schism that in 1054 divided Christendom into the Greek and Roman Churches. After the eighth century several circumstances contributed to open to the popes the way to supreme control over all churches. Among these were the establishing of new churches in Germany, which, like those of Britain at an earlier period, being founded by their missionaries, were at first subject to their power; the political confusion, and the change of government in Italy and France; the pseudo-Isidorian decretals, forged between 830 and 850 (which, in those times of ignorance, contributed much to support the claims of the Roman Church to exercise supreme power, by pretended letters and statutes of former bishops of Rome, dated back to the first centuries); the schism between the Eastern and Western Churches, which bound the latter still more closely to the popes as their leaders; the gradations of ecclesiastical rank (see HIERARCHY) everywhere introduced by the ambition of the popes, all derived and gradually descending from them, who had assumed the highest place; and, finally, the personal superiority of some popes over their contemporaries. Thus, Leo the Great in the fifth century; Gregory I., called the Great, a zealous, good, and able man, in the sixth century; and Leo III., who crowned Charlemagne, in the eighth century, had obtained for the Papal title an authority which the patriarchs of the East could not attain, and against which the power of princes availed little. There were, indeed, unworthy popes during the middle ages; but after the brilliant

victory which Nicholas I. (who was first solemnly crowned) obtained over Lothaire, king of Lorraine, in the affair of a divorce in 865, and over the Bishops of Trèves and Cologne, whom he deposed by his Papal authority; and after the example which John VIII. had given in 875, of a disposal of the imperial crown, which he conferred on Charles the Bald, the power of the popes could receive but little injury from the violence and corruption which prevailed in the Papal see for more than a hundred years. This corrupt state, due at first mainly to the influence of the Tuscan counts at Rome under Sergius III., early in the tenth century, was continued by the wicked and licentious favourites and relations of the infamous Princesses Theodora and Marozia (one of whom, John XII., in 956, while but eighteen years old, and another, Benedict IX., in 1033, a boy of twelve years, obtained the dignity of pope). Even the scandalous circumstance that in 1045 three popes, chosen by means of bribery, were living together in Rome did not affect the authority of the Papal see. The rudeness of the age concealed the scandal of such things. In the midst of all this darkness a ray of light appears in the reign of the excellent Sylvester II. (999–1003), who was one of the most learned men of his time, and whom the world regarded as a magician. The troubles arising during the decline of the Carlovingian dynasty in France and Germany offered an extensive and continually enlarging field of action to the ambition of the popes; and their dignity and independence of the nobles and people of Rome, which they had often lost during the contentions of factions, were regained by them by the constitution of Nicholas II., in 1059, placing the right of election to the Papal chair in the hands of the cardinals (see CONCLAVE), to the exclusion of the laity. After this a succession of good rulers, of great talents and excellent character, sat upon what was then the first throne in Christendom:—Gregory VII. (1073–85), who surpassed them all in spirit and in power, and who began to carry through with wonderful perseverance the project of universal dominion; Urban II., who was several times driven from Rome by the anti-pope Clement III., but who from 1088 to 1099 ruled with extensive influence and extraordinary vigour; Alexander III. (1159–81), who during his reign survived two rivals, and overcame a third, who brought the Kings of England and Scotland to unconditional obedience in religious matters, who made the Emperor Frederick I. hold his stirrup, and confirmed the system of the election of popes; and Innocent III. (1198–1216), whose reign raised the Papal see to the highest degree of power and dignity.

What the popes in earlier times had only attempted in peculiar circumstances, these great men, so superior to their age, made the settled usage by a regular series of bold measures and persevering efforts. They united the clergy of Western and Central Europe closely to the Papal see by the introduction of a new form of oath, by the law of celibacy, and by the law of investiture, which broke the union of bishops with their temporal princes, and under Innocent III. was extended to a power of disposing at pleasure of all the dignities and benefices of the church. By means of their legates and nuncios they obtained the bishop's right of deciding in ecclesiastical and matrimonial affairs, and the exclusive right of canonization; and they thus made the popes the sole fountain of ecclesiastical dignity and power in western christendom. By eventually assuming the sole right of convening councils and national synods (whose decrees became valid only by being ratified by the pope), and by maintaining with more and more boldness their claims to infallibility, they at length obtained complete dominion over the church. Of the orders of monks, especially of the mendicant orders, they created a spiritual army, who, having in their hands the Inquisition, the right of hearing confessions, and of preaching, together with the public superintendence of schools and universities, became the most useful instrument of their policy, and one of the strongest supports of their power. The success of these advances towards unlimited spiritual dominion gave them courage to strive also after temporal power.

But the claims of the popes to worldly dominion are of much later origin than the historians of the court of Rome have maintained. Constantine the Great gave them merely some buildings and estates in and near Rome. By the gift of Pepin (see CHURCH—STATES OF THE) the pope obtained merely the *dominium utile*, that is, the use of lands intrusted to him. In this way he became in a manner a vassal of the Frankish kings, and afterwards of the German emperors, who exercised without opposition the right of sovereignty over the Papal dominions, and until the twelfth century suffered no election of pope to take place without their ratification. Innocent III. first established the rule that Rome, the Marches, and the hereditary possessions of Matilda (see MANTUA) should do him homage as lord paramount, in 1198, and thus vanished the last shadow of the power of the emperors over Rome and the pope. Favourable circumstances had already made several kingdoms tributary to the Papal see. England was thus situated from the time of its conversion to Christianity, so were Poland and Hungary, from the eleventh century; Bulgaria and Arragon, from the beginning of the thirteenth; and the Kingdom of the Two Sicilies (whose Norman kings had been vassals of the pope), from 1265, when Clement IV. gave it to the house of Anjou through hatred towards the house of Hohenstaufen. Even the East would have fallen under the power of Rome if the success of the Crusades (which had given rise in the West to much confusion in regard to the rights of citizens and private property, and thereby promoted the influence of the pope) had been less transitory. Innocent III. dared to depose and proclaim kings, as, for instance, John of England, and to threaten the whole world with excommunication. The Emperor Otho IV. called himself such by the grace of God and of the pope. Kings were called *sons of the pope;* and the fear of the terrible consequences of the interdict which they pronounced as vicars of Christ upon disobedient princes and their kingdoms, the rebellious spirit of the barons, the ill-regulated constitution of states, and the great want of laws, subjected the rulers of those times to the authority of a lord whose court was the cradle of modern politics, and whose power and influence were irresistible, because supported by public opinion and by superstition. It was with reason, then, that the papacy at that time was called a *universal monarchy*. This priestly government, however, did good by accustoming the rude princes and people to laws and Christian manners; and at a time when rights were first beginning to be understood, its inconsistency with true independence was not felt.

France alone, which had acquired more consistency and power than the other monarchies of Europe by the subjugation of the great vassals and the reduction of their territories under the royal government, first successfully resisted the popes. In Philip the Fair Boniface VIII., one of the boldest and most able popes, found a master, and his successors, during their residence at Avignon between 1307 and 1377, remained under French influence. The independence of the popes visibly suffered from the circumstance that they were now bound to a particular political party, though they continued to exercise over all the Christian countries of the West the power which

their arts and perseverance had obtained. Their dignity sunk still lower when, in 1378, two rival popes appeared—the Italian Urban VI., and a count of Geneva, chosen by the French cardinals, who took the name of Clement VII. Europe was divided by their quarrel, the Italian being supported by Italy, Germany, England, and the northern kingdoms; the French pope by France, Spain, Savoy, Lorraine, and Scotland; and the schism long remained. The public sale of offices, the shameful extortions, and the low artifices which most of these rival popes used against each other, gave rise in England and Bohemia (see HUSS) to much complaint, and to demands for a reform in the state of the church. The council of Constance had, indeed, succeeded in putting an end to the great schism by deposing both of the rivals; but Pope Martin V., who was chosen in 1417 in their place, did not correct the abuses which had grown up under his predecessors, and even the most express decrees for reform, passed by the Council of Basel, were rendered nugatory by the artifices and the perseverance of Eugene IV., who was pope between 1431 and 1477. He had gained the friendship of France in 1438 by the Pragmatic Sanction, which laid the foundation of the freedom of the Gallican Church; and the negotiations of Æneas Sylvius, ambassador of Frederick III., with him and his successor, the excellent Nicholas V., a friend to ancient literature, and the protector of the learned exiles from Greece, effected the Concordat of Vienna in 1448. Why the grievances of the German nation were so little remedied by this instrument, while the interest of the pope was carefully attended to, the German princes, whom the eloquence of the cunning negotiator Æneas Sylvius had induced to accept it, first perceived when he was chosen cardinal, and in 1458 pope, under the name of Pius II. In this Concordat the popes obtained the confirmation of the annates, of the right of ratifying the election of prelates, and many other privileges.

In care for his family no pope ever surpassed Alexander VI. (1492–1503), whose training and qualifications fitted him for a temporal rather than a spiritual ruler. His successor Julius II. (1503–13), employed all his powers in politics, and in a war with France, in which he commanded his own army, but was obliged to flee before Bayard. Fortunately for him and for his successor, Leo X., Maximilian I. was prevented by circumstances, and finally by death, from uniting upon his own head the Papal and imperial crowns. The circumstance that Austria, France, and Spain were fighting for Lombardy and Naples, and therefore sought alternately the favour of the pope, had caused the latter to rise anew in political importance towards the end of the fifteenth century; but the spirit of the times was acquiring an irresistible strength, and the policy of Leo X. was of no avail against it. Luther, Zuinglius, and Calvin were the heralds of an opposition which tore almost half of the West from the popes, while the policy of Charles V. was at the same time diminishing their power. What the ages of ignorance had allowed to the pope the Council of Trent indeed now ratified; and the Society of the Jesuits came forward as the guards of his throne, striving to erase all traces of the Reformation in the states which had remained Catholic, and to regain by missions among the heathen what had been lost in Europe; yet neither this new support, nor the policy of artful popes such as Clement VII. (1523–34), whom Charles of Bourbon, the general of the emperor, drove in 1527 into the castle of St. Angelo; and Paul III. (1534–49), who gained for his family Parma and Piacenza; nor the monkish devotion of Paul IV. (1555–59); nor the moderation of Pius IV. (1559–65), who condescended to grant the cup to the Bohemian Hussites; nor the severity of Pius V. (1566–72), who offended both princes and people by his bull In cœna Domini, worthy of his previous character as a proud Dominican and furious persecutor of heretics, although his severe austerity obtained him the honour of canonization; still less the useful activity of Gregory XIII. (1572–85), who gave to the world the amended calendar (Gregorian); the magnanimity and wisdom of Sixtus V. (1585–90); the good fortune of Clement VIII. (Aldobrandini, 1592–1605), who in 1598 added Ferrara to the States of the Church; the learning of Urban VIII. (1623–44), who added Urbino to his dominions, and obliged Galileo to abjure his doctrine of the motion of the earth round the sun,—could restore the old authority of the Papal throne. In vain did the court of Rome employ the language of Gregory VII. and Innocent III.; even in Catholic states the distinction between ecclesiastical and political affairs had been perceived so clearly that the influence of the popes upon the latter was now very limited.

Since the middle of the sixteenth century no German emperor had been crowned by a pope. The princes who had learned his policy withdrew themselves from his authority. The national churches obtained their freedom in spite of all opposition, and the Peace of Westphalia, which the Papal see never acknowledged, gave public legality, guaranteed by all the powers of Europe, to a system of toleration which was in direct contradiction to the papal doctrines. Under such circumstances the question no longer was how to extend the papal authority, but how to prevent its utter destruction; and the vicar of Christ, who, when he began to call himself servant of servants, was lord of lords, was obliged to play the part of a suppliant, who claims compassion and toleration rather than obedience. Jansenism also took from the popes a considerable part of the Netherlands; their bulls were no longer of avail beyond the states of the Church without the consent of the sovereigns, and the revenues from foreign kingdoms grew smaller and smaller. In France, and soon after in Germany, they became the objects of ridicule; and the excellent men who occupied the pontifical chair in the eighteenth century, the learned Lambertini (1740–58) (see BENEDICT XIV.), and the enlightened Ganganelli (Clement XIV., 1769–74), were forced to expiate the guilt of their predecessors, and sought to obtain, by means of patience, condescension, and personal merit, the esteem and influence which the others had haughtily claimed.

Still greater misfortunes fell upon their successors, Pius VI. (1775–98) and Pius VII. (1800–23). The first, after a bitter experience of the progress of knowledge, just when the death of Joseph II. had inspired him with new hopes, was witness of the revolution which tore from him the French Church, and deprived him of his dominions. The other was forced to buy his personal freedom, and the possession of his diminished states, by an equivocal concordat with Bonaparte in 1801, and by much personal humiliation, and lost them both again in 1809. He owed his restoration in 1814, not to the excommunication which he had pronounced against Napoleon, but to a coalition of temporal princes, among whom were two heretics (the English and Prussian) and a schismatic (the Russian). Nevertheless, he not only restored the Inquisition, the order of the Jesuits, and other religious orders, but advanced claims and principles entirely opposed to the ideas and resolutions of his liberators. He openly declared against the toleration of the philosophic sects, against Bible societies, and translations of the Bible. (See PIUS VII.) In the meantime there appeared in the French and German Catholic churches a spirit of freedom, and an increasing wish for an independent national

church. The same spirit that actuated Pius VII. actuated, in like manner, his successors, Leo XII. (1823–29), Pius VIII. (1829–30), and, above all, Gregory XVI. (1831–46). The rigour with which the last-mentioned pope opposed and suppressed every reform in the civil relations of the Papal dominions, which the spirit of the time dictated, contributed greatly to the outbreak of the revolution of 1848, which obliged his successor Pius IX. to flee from Rome, and prepared the way for the establishment of a Roman republic. It was only by means of the aid afforded by Austria and France that the temporal power of the Papacy was not entirely swept away. This power was further weakened by the events of 1859 and 1860, which resulted in all the States of the Church being seized upon by the Sardinian troops, with the exception of Rome, Civita Vecchia, and certain districts that were occupied by the French army. Hostilities again broke out in 1866, when Garibaldi entered the Papal territory and defeated the pontifical troops at Monte Rotondo (October 26), though a few days later he himself was in turn completely vanquished by the united pontifical and French armies. After the withdrawal of the French troops from Italy in 1870, King Victor Emmanuel took possession of Rome, and since that time the pope has lived in seclusion in the Vatican.

Previous to the Vatican Council, which assembled in 1870, Papal infallibility was the subject of much controversy, but that council settled the matter definitely in declaring the pope to be infallible. According to the decrees of this council the pope has not only the office of inspection and direction, but also the whole fulness of supreme power in discipline as well as of faith, and this power is ordinary and immediate over all and each of the pastors and of the faithful. The pope may on sufficient grounds withdraw jurisdiction from a particular bishop, but cannot destroy the episcopacy. In virtue of his office he has direct power over each Catholic in any particular diocese; the bishop of such diocese, though still having the same power pertaining to his office, must exercise it in union with and subordination to the pope. It is further taught by the Vatican Council that when the pontiff speaks *ex cathedra*—that is, when he, using his office as pastor and doctor of all Christians in virtue of his apostolic office, defines a doctrine of faith and morals to be held by the whole church, he, by the divine assistance promised to him as the successor of St. Peter, possesses that infallibility with which Christ was pleased to invest his church in the definition of the doctrine on faith and morals, and that, therefore, such definitions of the pope are irreformable in their own nature, and not because of the consent of the church. The pope in himself is liable like other men to error; his infallibility comes from the Holy Spirit, which on certain occasions protects him from error in faith and morals. He has no infallibility in merely historical or scientific questions. In matters of faith and morals even he has no inspiration, and must employ the same means of theological research as other men. He may even err as a private doctor; nor is any immunity from error accorded to books he may write and publish. Even when he speaks with apostolic authority he may err, the theory of the Vatican Council being that God protects him from error in definitions on faith and morals when he imposes belief on the Universal Church. Extensive as the power and functions of the pope may thus appear to be, it would be an error to suppose that he was an absolute monarch. He cannot annul the constitution of the church as ordained by Christ, his power of definition is circumscribed by numerous definitions originating from his predecessors, previous councils, &c. If he obstinately rejected an article of faith which has already been proposed by the church, and to which he himself owes allegiance equally with the simplest of the faithful, he might be judged and replaced.

The pope may condemn or prohibit books; may reserve to himself the canonization of saints; and may alter the rites of the church in matters which are not essential. Frequently on such occasions, though exercising his supreme authority, he does not speak *ex cathedra* or claim infallibility. To the pope belongs the supreme direction of discipline; he may enact laws for the whole church; he can inflict censures such as excommunication on all Christians, and reserve to himself the prerogative of absolution from certain sins. He alone can erect, suppress, or divide dioceses, translate or deprive bishops, and that without crime on their part, should the general good of the church demand it; and he alone, also, can approve new religious orders, and exempt them if he deems it expedient from episcopal jurisdiction. A pope has no power to nominate his successor, election (which at first was in the hands of the whole Roman community, but subsequently was greatly controlled by the rulers of Italy, France, Germany, and Spain) being now entirely in the hands of the cardinals. (See CONCLAVE.) The cardinals are not bound to choose one of their own body; a layman and even a married man may be lawfully elected.

We subjoin a table of the popes, according to the Roman Notizie, with the dates of the commencement of their pontificates. The names printed in italics are those of anti-popes:—

St. Peter	A.D. 42
St. Linus	66
St. Anacletus	78
St. Clement I.	91
St. Evaristus	100
St. Alexander I.	108
St. Sixtus I.	119
St. Telesphorus	127
St. Hyginus	139
St. Pius I.	142
St. Anicetus	157
St. Soterus	168
St. Eleutherius	177
St. Victor I.	193
St. Zephirinus	202
St. Callixtus I.	217
St. Urban I.	223
St. Pontianus	230
St. Anterus	235
St. Fabian	236
St. Cornelius	250
St. Lucius I. — *Novatianus*	252
St. Stephen I.	253
St. Sixtus II.	257
St. Dionysius	259
St. Felix I.	269
St. Eutychianus	275
St. Caius	283
St. Marcellinus	296
(See vacant 3 years and 6 months.)	
St. Marcellus I.	308
St. Eusebius	310
St. Melchiades or Miltiades	311
St. Sylvester I.	314
St. Marcus	336
St. Julius I.	337
Liberius	352
St. Felix II. (sometimes reckoned an Antipope)	355
St. Damasus I.	366
St. Siricius	384
St. Anastasius I.	398
St. Innocent I.	402
St. Zosimus	417
St. Boniface I.—*Eulalius*	418
St. Celestine I.	422
St. Sixtus III.	432
St. Leo I. the Great	440
St. Hilary	461
St. Simplicius	468
St. Felix III.	483
St. Gelasius I.	A.D. 492
St. Anastasius II.	496
St. Symmachus	498
St. Hormisdas—*Lawrence*	514
St. John I.	523
St. Felix IV.	526
Boniface II.—*Dioscorus*	530
John II.	533
St. Agapetus I.	535
St. Sylverius	536
Vigilius	537
Pelagius I.	555
John III.	560
Benedict (I.) Bonosus	574
Pelagius II.	578
St. Gregory I. the Great	590
Sabinianus	604
Boniface III.	607
St. Boniface IV.	608
St. Deusdedit	615
Boniface V.	619
Honorius I.	625
(See vacant 1 year and 7 months.)	
Severinus	640
John IV.	640
Theodorus I.	642
St. Martin I.	649
St. Eugenius I.	654
St. Vitalianus	657
Adeotatus	672
Donus or Domnus I.	676
St. Agathon	678
St Leo II.	682
St. Benedict II.	684
John V.	685
Conon—*Theodorus; Paschal*	686
St. Sergius I.	687
John VI.	701
John VII.	705
Sisinnius	708
Constantine	708
St. Gregory II.	715
St. Gregory III.	731
St. Zachary	741
Stephen II. (died before consecration)	752
Stephen III.	752
St. Paul I.—*Constantine; Theophylactus; Philip*	757
Stephen IV.	768
Adrian I.	772
St. Leo III.	795

Stephen V. ..... A.D. 816
St. Paschal I. 817
Eugenius II. 824
Valentinus 827
Gregory IV. 827
Sergius II. 844
St. Leo IV. 847
Benedict III.—*Anastasius* 855
St. Nicholas I. 858
Adrian II. 867
John VIII. 872
Marinus I., or Martin II.. 882
Adrian III. 884
Stephen VI. 885
Formosus 891
Boniface VI. (reigned only 18 days, and not included among the popes by Baronius and others) 896
Stephen VII. 896
Romanus 897
Theodorus II. — *Sergius III.* 898
John IX. 898
Benedict IV. 900
Leo V. 903
Christopher 903
Sergius III. 904
Anastasius III. 911
Lando 913
John X. 914
Leo VI. 928
Stephen VIII. 929
John XI. 931
Leo VII. 936
Stephen IX. 939
Marinus II., or Martin III. 943
Agapetus II. 946
John XII.—*Leo VIII.* ... 956
Benedict V. 964
John XIII. 965
Benedict VI. 972
Donus or Domnus II. 974
Benedict VII. 975
John XIV.—*Boniface VII.* 983
John XV. 985
Gregory V.—*John XVI.* .. 996
Sylvester II. 999
John XVI. or XVII. 1003
John XVII. or XVIII. ... 1003
Sergius IV. 1009
Benedict VIII.—*Gregory VI.* 1012
John XVIII. or XIX. 1024
Benedict IX. (deposed)—*John XX.* 1033
Gregory VI. — *Sylvester III.* 1045
Clement II. 1046
Damasus II. — *Benedict IX.* attempts to resume the throne 1048
St. Leo IX. 1049
Victor II. 1055
Stephen X. 1057
Benedict X. 1058
Nicholas II. 1058
Alexander II. — *Honorius II.* 1061
Gregory VII. (Hildebrand) —*Clement III.* 1073
(See vacant 1 year.)
Victor III. 1086
Urban II. 1088
Paschal II. 1099
Gelasius II. — *Gregory VIII.* 1118
Callixtus II. 1119
Honorius II.—*Celestine II.* 1124
Innocent II.—*Anacletus II.; Victor IV.* 1130
Celestinus II. 1143
Lucius II. 1144
Eugenius III. 1145
Anastasius IV. 1153
Adrian IV. (Nicholas Breakspear, an Englishman) 1154
Alexander III. — *Victor V.; Paschal III.; Callixtus III.; Innocent III.* 1159
Lucius III. 1181
Urban III. 1185
Gregory VIII. 1187
Clement III. 1187
Celestinus III. 1191
Innocent III. ..... A.D. 1198
Honorius III. 1216
Gregory IX. 1227
Celestinus IV. 1241
(See vacant 1 year and 7 months.)
Innocent IV. 1243
Alexander IV. 1254
Urban IV. 1261
Clement IV. 1265
(See vacant 2 years and 9 months.)
Gregory X. 1271
Innocent V. 1276
Adrian V. 1276
John XIX. or XX. or XXI. 1276
Nicholas III. 1277
Martin IV. 1281
Honorius IV. 1285
Nicholas IV. 1288
(See vacant 2 years and 3 months.)
St. Celestinus V. 1294
Boniface VIII. 1294
Benedict XI. 1303
Clement V. (papacy removed to Avignon) 1305
(See vacant 2 years and 3 months.)
John XXII. 1316
Benedict XII.—*Nicholas V. at Rome* 1334
Clement VI. 1342
Innocent VI. 1352
Urban V.—*Clement VII.* 1362
Gregory XI. (throne restored to Rome) 1370
Urban VI. 1378
Boniface IX. — *Benedict XIII. at Avignon* 1389
Innocent VII. 1404
Gregory XII. 1406
Alexander V. 1409
John XXIII. 1410
Martin V.—*Clement VIII.* 1417
Eugenius IV.—*Felix V.* 1431
Nicholas V. 1447
Callixtus III. 1455
Pius II. 1458
Paul II. 1464
Sixtus IV. 1471
Innocent VIII. 1484
Alexander VI. 1492
Pius III. 1503
Julius II. 1503
Leo X. 1513
Adrian VI. 1522
Clement VII. 1523
Paul III. 1534
Julius III. 1550
Marcellus II. 1555
Paul IV. 1555
Pius IV. 1559
St. Pius V. 1566
Gregory XIII. 1572
Sixtus V. 1585
Urban VII. 1590
Gregory XIV. 1590
Innocent IX. 1591
Clement VIII. 1592
Leo XI. 1605
Paul V. 1605
Gregory XV. 1621
Urban VIII. 1623
Innocent X. 1644
Alexander VII. 1655
Clement IX. 1667
Clement X. 1670
Innocent XI. 1676
Alexander VIII. 1689
Innocent XII. 1691
Clement XI. 1700
Innocent XIII. 1721
Benedict XIII. 1724
Clement XII. 1730
Benedict XIV. 1740
Clement XIII. 1758
Clement XIV. 1769
Pius VI. 1775
Pius VII. 1800
Leo XII. 1823
Pius VIII. 1829
Gregory XVI. 1831
Pius IX. 1846
Leo XIII. 1878

The dates in the above list are not always, particularly in the earlier part, accurately ascertained. The legend about Peter's bishopric at Rome from 42 to 67 is derived from the pseudo-epigraphic Clementines and Recognitions, an authority which is now by many considered to be entirely untrustworthy. The silence of the epistle to the Romans, which was written about 58, is alone sufficient to prove the worthlessness of the legend. Linus is supposed by some writers to have been the vicegerent of Peter as well as his successor.

POPISH PLOT, an imaginary conspiracy which Titus Oates (which see) pretended to have discovered in 1678, and by which he succeeded in deluding the mind of the nation over a space of two years, and causing the death of many innocent Catholics. The delusion, moreover, was fostered by some political leaders, with a view to promoting their own party schemes, and there is no doubt that not a few circumstances of the time tended to countenance the delusion. The Roman Catholics were particularly busy with their machinations at the time, and were not without hopes of seeing Catholicism reinstated as the ruling power in England. The plot, it was alleged by Oates, was formed by the Jesuits and Roman Catholics for the purpose of murdering the king (Charles II.), and subverting the Protestant religion. After some preliminary steps Oates went to Sir Edmondbury Godfrey, a justice of peace, and gave evidence before him of all the articles of the pretended conspiracy. Among the persons accused was Coleman, secretary to the Duchess of York, among whose papers was found a correspondence with some Catholics abroad, which contained expressions of great violence and indiscretion, but little to countenance the notion of such a plot. In the midst of the alarm created by this pretended revelation Godfrey was found dead in a ditch (October 17), and the cry was immediately raised that he had been murdered by the Papists on account of his taking Oates's evidence, though nothing transpired that could substantiate that view. Parliament met soon after this event, and the two Houses immediately began to occupy themselves with examinations in regard to the plot. Before a week had elapsed a bill was passed by the Commons to exclude the Catholics from both Houses. The Commons likewise passed a resolution, which was afterwards ratified by the Lords, to the effect 'that there had been and still was a damnable and hellish plot, contrived and carried on by the Papist recusants, for assassinating the king, subverting the government, and rooting out the Protestant religion.' The encouragement held out to Oates, who received a pension of £1200, brought forward Bedloe, a noted thief and impostor, who confirmed Oates's statements, with some additions of his own. He accused several noblemen by name of a design to raise forces in different parts of the kingdom, with which they were to join an army of 20,000 or 30,000 crusaders to be landed from Spain. Although no arms, after the most rigorous search, no ammunition, no money, no commissions, no papers, no letters, were discovered to confirm the evidence of these men, yet the story obtained general belief, and excited a general panic. To increase the excitement Bedloe published a pamphlet, entitled A Discovery of the horrid Popish Plot for burning London and Westminster, &c., in which all the fires that had happened for several years were ascribed to the Jesuits. Meanwhile the pretended conspirators were brought to trial. Coleman, a Jesuit named Ireland, Grove, and Pickering, who, it was pretended, were engaged to shoot the king, were condemned to death on the testimony of Oates and Bedloe, and executed. The pretended murderers of Godfrey next suffered the

same fate, on the sole testimony of Bedloe, and one France, whom he had accused of being an accomplice in the murder, and who, after many promises and threats, finally confessed his guilt. Further prosecutions took place in the following year, when several persons were executed, and a new plot, called the *meal-tub plot*, from the place where the papers relating to it were found, was got up by one Dangerfield, a convicted felon. In 1680 Viscount Stafford was impeached by the Commons, condemned by the Lords, and executed, December 29, as an accomplice in the plot, on the testimony of Oates and two of his associates, Bedloe having died not long before. This was the last instance of bloodshed in this strange affair. Soon after the accession of James II. (1685) Oates was tried and convicted on two indictments for perjury, and was sentenced to be whipped on two different days from Aldgate to Newgate, and from thence to Tyburn, to be imprisoned for life, and pilloried five times every year. Referring to the Popish plot, Hallam justly remarks that, 'though it was a most unhappy instance of the credulity begotten by heated passions and mistaken reasoning, yet there were circumstances, and some of them very singular in their nature, which explain and furnish an apology for the public error, and which it is more important to point out and keep in mind, than to inveigh, as is the custom in modern times, against the factiousness and bigotry of our ancestors. For I am persuaded that we are far from being secure from similar public delusions, whenever such a concurrence of coincidences and seeming probabilities shall again arise, as misled nearly the whole people of England in the Popish plot.'

POPLAR (*Populus*), a genus of plants belonging to the natural order Salicaceæ, or, according to some, to the sub-order Amentaceæ and to the Diœcia Octandria of Linnæus. The species are trees often of large dimensions, having their buds usually covered with an aromatic and viscous substance; their flowers disposed in aments, and always appearing before the development of the leaves; and these last alternate, rounded, or triangular, serrate or dentate, and supported on long petioles, which are more or less compressed, particularly towards their summits. This conformation occasions a peculiar vibratory motion in the leaves when they are acted upon by the wind, especially remarkable in the Aspen, which appears to be perpetually agitated. On account of their rapid growth poplars are frequently planted in bare localities, as they may be expected to furnish an almost immediate effect. The timber of the poplar, which is white, light, and soft, is used for various purposes, but is not very valuable. About twenty species are known, all confined to the northern and temperate regions of the globe. Among the more remarkable of these may be mentioned: the Gray Poplar (*P. canescens*), a large spreading tree, of vigorous growth, and a native of Britain; it flowers in April, and the seeds are generally ripe in June; in a favourable situation it grows from 30 to 40 feet in ten years; its timber is generally used for the same purposes as common deal. The White Poplar (*P. alba*), resembles the last in appearance, though it is not so vigorous; the upper surface of the leaf is of a darker green, and the under side is of a brighter white. The most beautiful variety of this species is the Egyptian Poplar—the Aspen (*P. tremula*), indigenous to Britain and to mountainous situations throughout Europe and Asia; it is of a stately appearance, attaining sometimes to a great height, and is extremely hardy. The bark is used for tanning leather. The Lombardy Poplar (*P. fastigiata*) is a native of Italy, and now quite common in Britain; it is readily distinguished from every other species by its upright growth, and the taper shape of its head, from having its lateral branches closely gathered round the stem. Its wood is soft and light, suitable for packing cases, barrows, buckets, and the like. The Black Italian Poplar (*P. monilifera*), called also the Canadian Poplar, is a tree of very rapid growth, becoming of timber size in a few years. It is profitably grown for flooring, &c. Lastly, we shall mention the Balsam Poplar (*P. balsamifera*), a native of North America, where it attains a height of 80 feet; but in Britain its stature is much less; it grows vigorously for a few years. It is purely ornamental. The young wood is of a rich chestnut colour, and the buds are large and incased in a glutinous balsam.

POPLIN, a kind of finely woven fabric, made of silk and worsted. In the best poplins the warp is of silk and the weft of worsted, a combination which imparts peculiar softness and elasticity to the material; in the cheaper makes cotton and flax are substituted for silk, which produces a corresponding deterioration in the appearance of the stuff. The manufacture of poplin was introduced into Ireland from France in 1775 by Protestant refugees, and Ireland is still famous for its production. The term 'poplin' is a corruption of the French *papeline*.

POPOCATEPETL (Aztec, *popoca*, to smoke, and *tepetl*, a mountain), a volcano in Mexico, in the province of Puebla; lon. 98° 33′ W.; lat. 18° 36′ N. This volcano is constantly in action, throwing out smoke, ashes, and fire; but no great eruption has hitherto taken place. Its figure is that of a truncated cone, with a large crater, about 3 miles in circumference and 1000 feet deep. It is 17,783 feet high, and is one of the highest mountains between the Bay of Panama and Behring's Straits.

POPPY (*Papaver*). The species of poppy are herbaceous plants, all bearing large, brilliant, but fugacious flowers. The White Poppy (*P. somniferum*) yields the well-known opium of commerce. (See OPIUM.) Most of the species are natives of Europe, often occurring as weeds in fields and waste places, and frequently also cultivated in gardens for ornament. On the Continent the white poppy is extensively cultivated for an oil which is yielded by the seeds, and employed for culinary purposes much in the same way as olive-oil. The roots of the poppy are annual or perennial; the calyx is composed of two leaves, and the corolla of four petals; the stamens are numerous, and the capsule is one-celled, but divided internally by several longitudinal partitions, and contains a multitude of seeds.

POPULATION. No feeling is more deeply seated in the human breast than the desire of offspring. The mere instinct of propagation which man has in common with all other animals, acquires in his case an extension and power from his intellectual elevation and the greatness of his nature, which is impossible in the case of the lower animals; and when to the social and other considerations, the influence of which is peculiar to mankind, we add the attractions which imagination lends to the passion of love, and the power which that faculty possesses of compensating for the brevity and uncertainty of life, by projecting it with a semblance of reality and identity of interest into succeeding generations, it will readily be perceived that, however frequently celibacy may be enforced by circumstances, or prompted by religious zeal, a purely voluntary abstention, unmotived save by want of inclination, or the strength of opposing tastes, will always be so rare as to be wholly inappreciable in its general effects, so that its complete absence may be assumed as the basis of a scientific discussion of the laws of population. But although taking mankind in the mass the individual desire to contribute to the increase of the species may be held

to be universal, the actual growth of the population is nowhere entirely left to the unaided force of this motive. In respect to the gratification of this desire men are to some extent rivals, because, except in new communities, there are few societies in which all can have the opportunity of gratifying it; yet this rivalry is less felt than the sympathy which all have in common with a universal sentiment; and there are common as well as individual motives for encouraging population, to which this sympathy gives greater activity. Hence, in almost all primitive societies, and in many advanced ones, marriage, as the means of contributing to the maintenance and growth of population, has been regarded, if not as a matter of positive religious obligation, yet as possessing a natural moral sanction of almost equal weight, and to obviate any obstructions which the organization of society might put in the way of its universality, it has been held to be a matter of state policy to encourage it by positive laws. Besides the natural sentiment an adventitious circumstance has greatly contributed to make the encouragement of population a constant object of state policy. Mankind has hitherto lived in a state of chronic warfare. Contiguous nations, both barbarous and civilized, continue to maintain, as they have always maintained, their possessions against each other by a show of force; and from time to time questions arise between the most advanced nations, which are only settled by extreme violence, and a wholesale destruction of human life. However melancholy this condition of human society may be, it has to be reckoned with as a fact, and as no means have yet been discovered of remedying it, such outbreaks of destructive violence may be looked for in the future as in the past. Now there are several effects which this state of things has upon the growth of population which have an obvious influence on state policy. As long as a state of violence is normal, as long even as it may be resorted to on an extreme emergency, a motive for the growth of population is created which is independent of the resources of the community, or of the means of affording happiness or supplying material comfort to those who are called into being. Where war is the question numbers are strength, and other things being equal the community which can bring most men into the field will prevail. Heaven helps the strong battalion, is an approved maxim of trade-craft with men of the sword and rifle. Hence, whether for defence or attack, whether from motives of fear and jealousy or ambition, the numbers of a community become a matter of vital importance, and the question which, from the vulgar stand-point of common statesmanship, it is natural to put is, not how many can the country support well? but how many can it support at all? But the state of warfare, while it raises the motive for encouraging population beyond the bounds of common prudence, or indeed of any other restriction, puts very distinct and frequently very severe restrictions upon the means of effecting the object. Soldiers are necessarily withdrawn from productive industry. During all the time of training and actual warfare, which in the case of standing armies is permanent, their labour is precluded from contributing to the fund by which the population is maintained, and out of which alone can come the means of increasing it. Owing to this and other circumstances a soldier's life is, to a considerable extent, one of enforced celibacy, and while a considerable number of men in the flower of life are prevented from contributing in the proportion they would naturally do to the growth of the population, the support of these celibates forms a burden on the rest of the community which restricts its means of increase. In actual war there is in addition to the ordinary burden the drain of human life, and the enormous expense at which war is maintained, while when the war is over the ranks of the army are recruited from those who remain, and the normal burden is not diminished. When a soldier is killed he ceases to be of any use for promoting population, but if he were not replaced the community would be relieved of the burden of keeping him; but as another is put in his place the community is weakened by a man, has still this burden to bear, and has besides to pay for the expense of killing the lost man, which is considerable. That nations under these circumstances uniformly prosper and grow in numbers says much for the natural strength of the reproductive principle. Another consideration, besides the exigencies of aggression or defence, has contributed to make the promotion of population a political object. The governing classes are usually the holders of property, and density of population increases the value of property, irrespective of the happiness or misery of the population as a whole. That which gives value to property is labour, and the greater the number of labourers in a community the greater will be the amount of service which the holders of property will be able to obtain in return for the use of their property.

The natural sentiment in favour of reproduction affects not only the religious and political, but the social and commercial views of men. Marriage is in all communities undoubtedly held to be a condition of honour as well as of bliss. Social distinction and innumerable minor privileges await it, and the natural incentives to adopt this state are thus largely increased, and in a way which is specially attractive to the young and inexperienced. Commerce adds a speculative element to the inducements to matrimony. It not only holds out hopes which encourage men to anticipate the calculations of prudence, but it makes marriage itself an available resource which can be counted on as having a distinct mercantile value. The universal sentiment in favour of marriage causes it to be regarded as a sort of certificate of character and guarantee of stability in a young man. Even when the act itself is imprudent he gains by it among those who have no special knowledge of the circumstances a *prima facie* reputation for prudence, and as it were steals a character by flattering the current prejudice. But commerce is itself only a species of war. Its votaries have a faith in the inexhaustibility of its resources as implicit as that of despots in the power of their legions; but as there can be no commerce in that which is not produced, commerce is as strictly limited by production as war is by the resources of those at whose expense it is carried on.

On a *prima facie* view of the problem of population then it appears that while there are in the organization of society itself considerable hindrances to the full development of the powers of reproduction inherent in the human race, the prevailing sentiment of mankind, as represented in religion, politics, social usages, and commercial enterprise, has been uniformly in favour of encouraging the use of these powers, so that the growth of population has come to be commonly regarded as an indispensable sign of the prosperity of a community.

The policy of population thus indicated, though founded on a natural sentiment, supports itself on so many aggressive movements—conquest, commerce, emigration, that it may not inaptly be designated as the war policy. In proof of its prevalence the laws and institutions of many ancient nations—Hindus, Chinese, Persians, Romans, might be cited, but it would be useless to give particular instances of what is all but universal. Even at the present day this

policy is upheld by a vast preponderance of popular opinion, and is not without scientific support. It is questioned only by a few political economists, whose views are generally met by misrepresentation.

The limited area and high civilization of Greece first suggested the view of the question which contemplates the dangers of over-population, and it was among her eminent philosophers and statesmen that the problem of population began to be considered in all its aspects. Plato and Aristotle (who writes on the subject like John Stuart Mill) propounded theories for the regulation of population, not such as would suggest themselves to modern views of humanity, but sufficient to indicate a keen perception of the natural tendency of population to overgrowth. But the times were unfavourable for giving practical effect to such views. The small states of Greece were constantly at war with each other when they were not engaged in repelling or in organizing foreign invasion, and they made free use of the resource of emigration. Hence the legislator of Sparta, the leading state of Greece, did all he could, according to his light, to encourage population, and this policy was generally followed in Greece, as elsewhere. The whole policy of Rome was opposed to the formation of any opinions founded on a non-aggressive view of the organization of society, and the state of the civilized world during the middle ages afforded equally little scope for the formation of such opinions. Thus the problem of population was relegated to modern times.

It was in an Essay on the Principle of Population, published in 1798 (revised in various editions from 1803 to 1826) by the Rev. T. R. Malthus, subsequently professor of political economy in the East India Company's College at Hailebury, Hertfordshire, that the question of population was first systematically treated, and in this work the theory of population is so stated and demonstrated that the principles of Malthus must hereafter form the foundation of any science of political economy worthy of the name. The work of Malthus has never rivalled in popularity that of Adam Smith on the Wealth of Nations, and it has been subjected to a kind and amount of vituperation to which Smith's was never exposed. Smith attacked the prejudices of his day, and when these were overcome he received without opposition his due meed of fame. Malthus has probed the fallacies of prepossessions which are those of human nature, and which spring up afresh in each generation. His opponents are consequently immortal, and even among the professors of political economy those who receive his views without caveat can hardly yet be reckoned the majority. Even the most ardent admirers of Malthus hardly venture to class him with Adam Smith; yet if the intrinsic value of the positions demonstrated, and the beauty and completeness of the demonstration are to determine the rank of a scientific work, that of Malthus can hardly be reckoned second to any other within the sphere of economy. To Smith, on the other hand, belongs the honour of being the pioneer of the science, and what is of more importance to his fame, his principles have been turned to practical account, while the day for the practical recognition of Malthus is yet to come, and his theory still remains the mere bugbear of the sentimentalist.

The preliminary observations on which Malthus founds his theory had often been made by economists, naturalists, and other writers. Malthus quotes an observation by Dr. Franklin, which supplies in a striking manner the fundamental fact on which the theory of population rests, that there is no bound to the prolific nature of plants or animals but what is made by their crowding and interfering with each other's means of subsistence. Were the face of the earth vacant of other plants, it might be gradually sowed and overspread with one kind only, as for instance with fennel; and were it empty of other inhabitants, it might in a few ages be replenished from one nation only, as, for instance, with Englishmen. Malthus also shows that in several minor countries voluntary checks to population, more or less effective, have been in operation. From the experience of America he lays down the position that a population unimpeded by artificial checks might double itself in twenty-five years. Actual statistics, as cited by Malthus himself, and as given by subsequent statists, point to a much shorter period, but this is immaterial. Taking a given area, such as that of Great Britain, Malthus supposes that by the best agricultural policy its produce might be doubled in twenty-five years. This rate of progression, however, could not be continued. Assuming that there is no practical limit to the increased fertility of land under the most effective husbandry, he assigns to this increased fertility as a limit more favourable than experience will allow, a continuance without diminution of the original rate of increase. Thus at the end of the second period of twenty-five years the produce would be to that at the end of the first period in ratio not of 4, but of 3 to 2. Applying this to the whole earth it is obvious that unimpeded population would increase in successive periods in the ratio of 1, 2, 4, 8, &c., and that after a given stage of cultivation had been reached, production would only increase in the ratios of 1, 2, 3, 4, &c. In this way the whole area of the earth would soon be occupied, and further increase, except in the restricted ratio of production, would become impossible. These facts Malthus generalizes by saying that population increases in a geometrical, while the means of subsistence only increase in an arithmetical ratio. It is this superior energy of reproduction which explains such facts as have already been adverted to in this article. To this is due the fact, that in spite of the ravages of war, famine, and disease, of the influence of trades destructive of life, and of artificial habits and vices which retard or hinder reproduction, the population of the earth, and in general of each particular country, is not only maintained, but continues to progress.

Population of course cannot continue to increase beyond the means of subsistence, and every actual increase beyond actual or immediately attainable means must lead to a destruction of life. In examining, however, the bearing on each other of the different ratios of increase of human life itself, and of the means of supporting it, Malthus has deduced a law to the proof of which a considerable portion of his work is devoted. It is upon this law that the practical importance and value of his theory depends, and it is on account of it that it has been so much misrepresented and so violently assailed. This law is that the energy of reproduction rises above all the ordinary accidents of human life and the inevitable restraints imposed by the various organizations of human society, so that in all the various countries and climates in which men have lived, and under all the constitutions by which they have allowed themselves to be governed, the normal tendency of population has been to press continuously upon the means of subsistence. If we take, for example, two extremes of good and bad government, say England and Turkey, we find under the one a scope given to the growth of population which is wholly wanting in the other. But if population should be advancing in England, and declining in the most neglected or misgoverned parts of the Turkish Empire, the cause of advance in one case will be the ease and security

with which the means of subsistence can be developed; the cause of decline in the other will be the depression of industry through the arbitrary exactions of the agents of government, and the insecurity of property from the insufficiency of the protection afforded to it. And in the advancing and the declining state alike the same phenomenon will be found, population pressing up to and touching the actual limit allowed by the means of subsistence.

But if population is thus actually limited by the means of subsistence, it cannot be prevented by these means from going further than these means will warrant. The check from the means of production will come, but only after population has exceeded them. It becomes then an inquiry of great importance by what kind of checks population is actually brought up at the point at which it is in fact arrested. This inquiry Malthus conducts along with the proof of the law of pressure of population on the means of subsistence, which forms his fundamental position. The one inquiry in fact illustrates and confirms the solution of the other.

Malthus divides the checks on population into two classes, preventive and positive, the one consisting of those causes which prevent possible births from taking place, the other of those which, by abbreviating life, cut off actual excesses of population. In a further analysis of these checks he resolves them into three—vice, misery, and moral restraint. This is in fact a cross division, as vice and misery include both positive and preventive checks.

The proof of his main position is historical and statistical. He adduces evidence from a great variety of sources bearing on the state of communities from the lowest to the highest stage of social organization, and including the leading nations both in ancient and modern times, and the result is a body of proof the uniformity of which could scarcely have been anticipated previous to systematic investigation. It is shown, for example, that in countries which, according to our notions, we might imagine to be very inadequately peopled, among the American Indians, for example, or the nomad tribes of Northern Asia, the pressure of population upon the means of subsistence is as clearly to be traced as in the most densely-peopled countries. The measure of the growth of the American Indians, for example, was the extent and productiveness of their hunting-grounds. In these, even when occupied only at a particular season, they claimed a right of property, and the violation of a seemingly unoccupied territory was to them a matter of as serious importance as that of a cultivated estate in a civilized country, and occasioned wars among neighbouring tribes just as similar encroachments do among civilized nations. It is thus easy to see how the Indians must have declined in numbers with the encroachments of the white men, and how reasonable a cause of hostility these encroachments afforded them. A similar proof is derived from a retrospective application of the theory to history, which is of great independent value. Historians had long been at a loss to account for the seemingly inexhaustible hordes which the comparatively barren regions of the north of Europe and Asia had been able to pour during protracted periods of time, as for example during the decline of the Roman Empire, upon the comparatively fertile south, and had been led even to conjecture that the north must then have been more densely peopled than now. Even Gibbon, who rejected this explanation, seemed to think that the growth of population in these regions must bear a direct ratio to its density, which leaves the facts of the case unaccounted for. Malthus finds the explanation in the wholesale emigration and consequent rarity of population itself. Upon his principle the elasticity of population must in fact be in inverse ratio to its density. When the attractions of a southern campaign withdrew a large mass of a northern population from its homes there was for a time no pressure to restrain the rapid growth of those who remained, which would at once rise up to something more or less near according to circumstances, to its geometrical limit, and in less than an ordinary generation. A fresh horde, inspired with the traditions of former successes, would be able to start from the same locality. Thus it was the very fertility of the south which in these days of violence kept the population of the north below its normal limit, and so made it a nursery of men. These invasions, it is to be remembered, were not mere drains of men, but in general real emigrations by families and tribes, which would not leave those who remained behind burdened with useless dependents.

In regard to the subsidiary inquiry the most striking point brought out is the rarity of moral restraint and the uniform action, in innumerable forms, of vice and misery. A crucial test of the inevitableness of the alternation between these checks is given by Malthus from the accounts of Cook and others of the South Sea Islands, and particularly of Otaheite. Here the salubrity and fertility of the climate banished disease, and gave within the limits of its area the utmost facilities for increase. On the other nand the populous character of all the neighbouring islands made emigration impracticable without war; and war, though frequent, was not sufficient to restrain population. Here was found in full operation an institution which, as an organization of vice, would do honour to the most civilized community. Among the higher classes of Otaheite there existed societies called Eareeoie, which were joined by the *élite* of both sexes, and the object of which was promiscuous intercourse without the procreation of children. When an Eareeoie woman was delivered of a child a piece of cloth dipped in water was applied to the nose and mouth to suffocate it. The manners of the common people were in accordance with the example set them by their superiors.

The replies to Malthus consist almost exclusively either in misrepresentations of what he has attempted to prove, or in partial views of the question. The former are astonishingly frequent, and the most absurd statements have been attributed to Malthus from his own day to this. One which he cites himself in his Appendix (1817) from the replies made to his work may serve as an example. 'Others, of whom Mr. Malthus is the leader, regard the vices and follies of human nature, and their various products, famine, disease, and war, as benevolent remedies by which nature has enabled human beings to correct the disorders that would arise from that redundance of population which the unrestrained operation of her laws would create.' Hazlitt doubts if Malthus did not at first hazard his theory as an amusing and extreme paradox; and John Hill Burton has expressed a view which still prevails with many political economists, that he failed to consider the influence of free trade, 'which puts all the world at the command of an increasing and producing people.'

Malthus's theory of the ratio between human powers of reproduction and the increase of the means of subsistence has indeed been questioned. It is frequently called exaggerated by those who assign no reason for doing so, but a form of argument used in reply to it is that animal growth is slower than vegetable, and that man being one of the most slowly-developed animals, his growth is among the slowest of those of organized beings, and that his increase must therefore be slower than that of his means of

subsistence. If one corn would suffice for one human being until another corn was grown, there would be abundant force in this argument until the world was so full of human beings that there was not room for a corn for each of them; but as each human being requires many corns, each must have a certain amount of space to grow them in, and if the growth of corn itself is limited by the area of fertile land, that of human beings must be much more so. A very common mode of replying to Malthus is to restate one of his checks to population in different words, and call it a reply to his theory. But by far the most mischievous mode of dealing with Malthus's theory is that most commonly adopted by hostile economists, to profess to accept it as abstractly true, but to treat it as a merely speculative truth of very remote practical application. Two things are generally relied upon by those who take this position to ward off the present application of the theory from a particular state—emigration and trade. Emigration can never be an efficient remedy for over-population, for two reasons. A spontaneous emigration to an extent to affect population can never take place except under the pressure of the misery resulting from over-population. And when the emigration has taken place it does not remove the spring of over-population, but increases its elasticity. The pressure of population is speedily renewed, and the same process has again to be repeated. Thus emigration presents at best an alternation of accumulating misery and partial relief. Trade, 'which puts all the world at the command of an increasing and producing people,' presents for the time at least a more substantial and satisfactory relief, and to those who can conceal from themselves the true nature of the problem which Malthus has proposed this may seem to put its practical application to an indefinite distance. That a trading country is not wholly dependent upon agriculture, and that as long as there are vast tracts of fertile territory thinly peopled, such a country may maintain a population greatly in excess of what its own agricultural resources would be able to provide for, is certain. It is conceivable that such a country may advance in population beyond its actual agricultural resources, and yet increase in prosperity. Even when the world has reached its maximum of population, there will still be trading and agricultural districts, and the former will be more densely peopled than the latter. The most favourable instance that can be found by those who adopt this reasoning of a country in the supposed position is Great Britain. Looking to its mining wealth, and manufacturing and trading facilities, they suppose that this country stands to the rest of the world in a relation somewhat analogous to that of a town to the surrounding country, so that they object to assign any limit to its population from agricultural and even from any kind of internal resources other than the industry of its inhabitants. Now in giving this description of its position these economists have only shown, contrary to their intention, that there is no case more urgently calling for the application of Malthusian doctrines, or more permanently dependent on them, than that of Britain. It is always in the town and not in the country that the worst evils of over-population develop themselves, and whatever may be the resources of a community, the progress of population is equally liable to press upon their actual development.

For, first, the position here described, and which is in reality that which Britain occupies, is a perilous one. It would, of course, be arbitrary and absurd to limit the population of a country like this to its agricultural resources; but there is not the less a natural gradation in the stability of the resources on which a country may rely for the most indispensable part of its means of maintenance, food subsistence. First in order of course come agricultural resources. Next may probably be placed mining and other industries which rest on actual material resources of the country. These are not only more liable to failure than agriculture, but are also exposed to variations in the value of the exported products from similar discoveries elsewhere. After these come manufactures resting on no special facilities. Such industries are very liable to fluctuation, and we have frequent instances of their changing from one locality to another. When they are relied on as a means of bringing food from abroad they come within the range of foreign competition, and the further they are pushed for this purpose the wider and the more difficult of defence becomes their outer line. Last of all comes pure commerce, or the exchange of the products of others. A seaboard is a permanent natural resource for commerce, but this is of itself only an auxiliary means. When it is available for the development of internal resources, or the exchange of home produce, it affords scope for a commerce of proportionate stability, but mere indirect exchange must always, in the nature of the case, be a precarious source of revenue. When a community depends upon all these sources together it has the greater need to keep its population well within the limit of its developed resources, so that it may be the readier to meet any emergency.

But, secondly, the whole of this argument is founded on a complete misconception of the scope of the Malthusian problem. Malthus has shown that at the natural rate of increase the population of the whole earth would double every twenty-five years at the outside. There is still plenty of room in the world. Why does it not go on doubling? Because of the operation in the populous districts of the three checks—vice, misery, and moral restraint. Population, as it does not spread, is actually pressed together in the populous districts, and subjected to these restraints. Now of these restraints there is one only which it is not desirable to abolish, and that is the one which is found most rarely in operation. Moral restraints may differ in degree of excellency as well as others, but taking the good along with the bad, the question is whether, even in the most civilized community, the growth of the population is kept at its actual level by moral restraint of any kind, or by vice and misery, and whether the human race as a whole has profited by its intelligence to regulate its own increase, or at best suffers it, like the lower animals, to be regulated by the external forces of nature. Those who take the optimist view of the question look with complacency to population returns, and declare their satisfaction with the actual rate of increase. They perhaps go the length of a general inference from the present and past conditions of the people, but they do not face the actual details of our progress. It is very well to argue that because the average duration of human life has been extended, and the standard of comfort of the population raised, we are at least in a progressive position in regard to this problem. But the general argument is not conclusive. Neither Malthus nor any one else has said that all vice, disease, and misery were due to over-population. It is certain that science has diminished other causes of disease, and therefore an increased duration of life does not prove the mitigation of this cause. It is also a mistake to suppose that a higher standard of living removes the danger of over-population to a greater distance. It is from the pressure of population upon the minimum standard, whatever it is, that the danger accrues. What happens when this pressure occurs is not that the standard is immediately lowered—that may be done

by a continued pressure—but the immediate results are misery and vice. That the British are subjected to such a pressure in no slight degree will be evident to any one who considers, not the actual growth, but the tendency of the population to grow, as exhibited in the single circumstance of the excessive infant mortality of large towns. If all these children grew up population would increase rapidly, and there would either have to be a great expansion of the means of subsistence, a lowering of the standard of living, or a greater mortality among adults. Through an extraordinary combination of circumstances this problem has come to concern the British perhaps more than any other people in the world. Their case has been stated, but we have also to consider that of India, the second most densely peopled country in the world (according to some statists the first), and one of the most rapidly progressive in population. Britain has been blamed for putting a stop to the wars by which that population was checked, and as in the case of India authority must for a long time do anything that is to be done for the general good of the people, while in England the interference of authority on such a question would not be tolerated, we have the opportunity of studying both phases of the question.

The application of the principles of Malthus to the science of economy has yet to be made. Malthus's own application is chiefly local. He discusses at considerable length the bearing of his theory upon the English poor laws and upon some of the economical questions of his day, and he has some good observations upon the influence of public opinion on the growth of population, and the effects to be anticipated from a thorough education in sound views of the subject, a consummation still as distant as in his own day; but in regard to the general principles of the science his view may be summed up in saying that if population is to be controlled by vice, misery, or moral restraint, moral restraint is better than vice or misery.

Dr. Chalmers thoroughly adopted the principle of Malthus, but like Malthus he points to a moral rather than an economical conclusion. Chalmers, in fact, formally despairs of the economical problem, and he reviews the whole sphere of economy in order to prove that we are shut up to a moral remedy. Now it is true that the question in ultimate analysis is one of morality, for over-population, with its attendant vice and misery, is the result of a series of acts of selfishness and inconsideration; but as the reformation must be general we shall have to wait very long before morality will be sufficiently advanced to effect it, and in the meantime the immoral people will be constantly increasing. Economy, therefore, cannot resign her proper function of trying to make the best of what morality we have.

It was one of the great merits of John Stuart Mill as an economist that he saw the full importance of the Malthusian problem. Mill takes the opposite course with it from Chalmers, and, in strict accordance with his utilitarian principles, brings morality down into the region of economy to meet it. This makes his treatment of the question resemble that of the Greek philosophers. But it is sufficient to say that the morality of Mill is not, and is never likely to become, the morality of the human race. Like Malthus he relies much upon public opinion, but he shows too much disposition to dictate to it.

PORCELAIN. See CHINA-WARE and POTTERY.

PORCH, an exterior appendage to a building, forming a covered approach to one of its principal doorways (Gwilt).

PORCIA, daughter of Cato of Utica. She first married M. Bibulus, Cæsar's colleague in the consulship (B.C. 59), by whom she had three children. Bibulus died in B.C. 48, and in B.C. 45 she married M. Brutus, who afterwards became the assassin of Cæsar. She is said to have induced her husband to confide the secret of the conspiracy to her, and on the day of its execution her anxiety for his safety was so great that she fainted away. After the death of Brutus she put an end to her life. The common story was that her friends having removed from her the means of self-destruction she effected her purpose by swallowing live coals. It is scarcely necessary to contradict this tale, which it is conjectured covers the fact of her having suffocated herself with the fumes of charcoal.

PORCUPINE, a genus of quadrupeds belonging to the Rodent or Gnawing order of Mammalia, and forming the type of a distinct family, that of the Hystricidæ. These forms are distinguished by the peculiar nature of the body-covering, which consists, especially in the back region, of hairs specially modified to form the so-called *quills*, or dense, solid, spine-like structures. These quills are intermixed with bristles and stiff hairs, and in some American species the quills are almost concealed beneath the hairy fur of the body. The incisor or front teeth number two in each jaw, as in the generality of Rodents. These teeth spring from permanent pulps, so that they continue to grow throughout the lifetime of the animal as in the other members of the order. The arrangement of the enamel and the dentine or ivory of these front teeth also tends to perfectly adapt them for their 'gnawing' operations. (See RODENTIA.) There are four molar teeth on each side of each jaw in the porcupines, these latter teeth exhibiting complicated foldings of the dentine or ivory substance bounded by enamel; and the molar teeth in the porcupines, like the incisors, continue to grow throughout life from persistent roots. The skull exhibits an infra-orbital foramen of very large size. The muzzle is generally short and of pointed conformation. The lip is divided. The ears are short and rounded. The anterior feet possess four, and the hinder feet five toes, all provided with strong thick nails. The clavicles or collar-bones are of rudimentary nature. The tongue is roughened, or, as in the Javan porcupine, may be provided with horny plates or scales.

The family Hystricidæ includes several distinct genera. Of these the first and most familiar is that of *Hystrix*, represented by the True Porcupines. Of this genus the Common or Crested Porcupine, *Hystrix cristata*, found in Southern Europe and in Northern Africa, is the best known species. The True Porcupines have non-prehensile tails, which may be spiny or covered with scales or bristles. When fully grown the Common Porcupine measures nearly 2 feet in length, and some of its spines exceed 1 foot. Its general colour is a grizzled, dusky black. The upper part of its head and neck is furnished with long, light-coloured hairs, capable of being raised or depressed at pleasure; and most parts of the back and sides are armed with spines, which are longest on the centre of the back. In their usual position they lie nearly flat upon the body, with their points directed backwards; but when the animal is excited they are capable of being raised. This elevation of the spines is effected by the development of special skin muscles, collectively named the *panniculus carnosus*. This same muscle is developed in the hedgehog, and enables that animal to roll itself up in the well-known fashion. The spines are banded black and white, and are extensively used as holders for steel pens and for paint brushes. The quills are loosely inserted in the skin, and may, on being violently shaken, become detached —a circumstance which may probably have given rise

to the purely fabulous statement that the animal possessed the power of actually ejecting its quills like arrows or darts at an enemy. Aristotle, Pliny, and Oppian mention this as a veritable fact, whilst another statement was gravely made of the porcupine that it actually carried water for its young in the presumed hollow quills of the tail! These animals generally lead a solitary life, and inhabit burrows during the day, coming forth at night in search of food, which consists chiefly of vegetable matter. The common species is quiet and peaceable, but shows no disposition to become familiar or domesticated. An Indian form (*H. Nepalensis* or *leucurus*) resembles the Crested Porcupine in form, but is larger, and possesses white spines on the tail. No hairy covering exists; and the nails are shorter, the ears being less rounded than in the European form.

The porcupines generally inhabit warm or tropical regions, and are represented by distinct genera in both hemispheres. The name 'porcupine' itself is derived from the French, and signifies 'spiny pig'—a designation not altogether inappropriate, if the pig-like form of the animals and the grunting sound they produce are taken into consideration.

The genus *Atherura*, including two species, possesses a long scaly tail, which is terminated by a tuft of bristles. The species of this genus occur in India and other parts of Asia and in the Eastern Archipelago. The *Atherura fasciculata* or 'Fasciculated Porcupine' is a familiar species of this genus. Its colour resembles that of the Common Porcupine, the upper parts and outer sides of the limbs being coloured of a dusky hue; whilst grayish-white prevails in the under parts, the inner sides of the limbs, and the front of the neck and throat. A transverse black band marks the breast above the fore legs.

Of the American species, the Canadian or North American Porcupine (*Erethizon dorsata*) is the best known. The quills in this species are short, and are concealed amongst the fur. This species is of slow, sluggish habits. The ears are short, and hidden by the fur. The tail is comparatively short. It is about 2 feet long; of a brownish colour, mingled with white; the spines are attached in a very slight manner to the animal, and, from being barbed at the tip with numerous small reversed points or prickles, they by degrees penetrate very deeply into the flesh after having once pierced it. Small and insignificant as these defensive weapons may appear, they are capable of causing the death of dogs, wolves, or indeed of any animal that incautiously attempts to seize the porcupine. These spines or quills are much used among the Indians to ornament different articles of dress: they dye them of various colours, in a very permanent manner. The Canada porcupine is principally found in the northern parts of the United States and in Canada, the northernmost limit of its distribution being at latitude 67° N., on the shores of the Mackenzie River. It is said to be rare in Virginia, but numerous in some parts of Kentucky. They feed on the barks of various trees, apples, corn, &c. Their flesh is said to be very unpalatable, resembling flabby pork. They pair about the latter end of September, and the female brings forth two young in April or May.

The genus *Cercolabes* of South America possesses a distinctive feature in the elongated prehensile tail, adapting it for an arboreal existence. These latter forms may thus be termed 'Tree Porcupines.' About six species of these animals are indigenous to America, the spines, as in the Canadian Porcupine, being of much smaller size than in the Old World forms. In length the typical species of this genus averages 1½ feet, the tail measuring about 10 inches.

Other genera are *Synetherus* and *Aulacodus*. The former includes only the Mexican Porcupine, the latter occurring in West and South Africa. The bodies and tails of the species of the genus *Aulacodus* are more elongated than is usual, and the tails are covered with prickly hairs. They average large rabbits in size. (Pl. CLXXII.–CLXXIII., fig. 18.)

PORDENONE, a town of Italy, in the government and 40 miles N.N.E. of the city of Venice, in a plain on the Nocelle. It is surrounded with an old wall, is a well-built, stirring place; with two parish and six auxiliary churches; a theatre, hospital, and workhouse; manufactures of linen, copper utensils, paper, and glass; and a considerable trade in corn and wine. Pop. 6072.

PORDENONE, IL (so called from his birth-place, Pordenone in Friuli, his true name being Giovanni Antonio Licinio), or REGILLO DA PORDENONE, a painter of the Venetian school, and an early collaborateur and rival of Titian, was born about 1484, and executed many works for his native place; some also for Mantua, Vicenza, and Genoa; but his greatest works for Venice. For this city he painted the chapel of St. Roch, and the hall of the Pregadi, in conjunction with Titian, with whom he also painted in St. John's church, whence a constant rivalry existed between them. He died in Ferrara (1540), whither he had been invited by the Duke Ercole II., to prepare cartoons for Flemish tapestry. His death was attributed to poison. Specimens of his works are to be found in many of the principal galleries of Europe.

PORIFERA ('pore-bearing'), a term occasionally employed to designate the Foraminifera or the Sponges, or both of these classes of Protozoa (which see). The name has been applied in allusion to the apertures or pores which exist in both groups of organisms. The Foraminifera thus possess minute apertures or *foramina* in their calcareous shells, and through these apertures the sarcode matter of their bodies is protruded in the form of filamentous processes termed *pseudopodia*. The name Foraminifera is thus equivalent in its etymological sense to Porifera. The 'pores' in the Sponges are the smaller apertures existing in the sponge-material, and through which currents of water are continually being drawn. (See also PROTOZOA and SPONGES.) The term Porifera, in modern zoology, it may lastly be mentioned, is by no means frequently used; the two classes above alluded to, and which are essentially and structurally distinct, being designated by their own special names in the classification of the Protozoa.

PORK, the flesh of swine, is one of the most important and widely used species of animal food. Fresh pork, though by some considered a delicacy, especially when killed young, is a much inferior article of diet to beef or mutton, and is much less used. The flesh of pork, particularly the lean, is coarser and ranker than that of the other animals chiefly used for food, but there are certain advantages which give pork a place in the supply of animal food that can be filled by no other article. The appetite of swine being much more catholic than that of their daintier neighbours, the feeding of them answers the purposes of economy, and extends very materially the supply of food. This, it is true, is attended with considerable dangers. If care is not taken that the feeding of swine should be wholesome and cleanly, their flesh becomes tainted with disease and unfit for food. Unscrupulous breeders sometimes take advantage of their exorbitant and omnivorous appetite to make them consume the most disgusting offal, and even when their feeding is not conducted with this utter recklessness of consequences it is often less careful than is consistent with sound sanitary conditions. There is in fact no animal to the perfection of whose flesh as an article of diet careful attention to feeding is more indispensable.

The main recommendation of pork lies in its superiority to other kinds of animal food in undergoing the process of curing. The quality of beef and mutton is seriously deteriorated when long kept, even under the best methods of curing; that of pork is decidedly improved, and when of good quality and well cured it develops a richness and delicacy of flavour in marked contrast with the dryness and insipidity of other salted meat. Another recommendation of pork is the abundance and very digestible quality of its fat, which makes it a very suitable diet for cold climates, but which is, on the contrary, rather a disadvantage in hot ones. For long sea voyages, especially before the introduction of modern methods of keeping fresh meat, pork was by far the most common and acceptable form of animal diet, and it is still one of the most valuable items in naval stores.

The swine was among the unclean animals forbidden to be eaten by the Mosaic law. It is still regarded by the Jews as specially typical of the unclean animals. The Egyptians, Arabians, and other eastern nations had similar opinions as to the use of pork. The breeding of swine is common among the Irish peasantry, but the chief source of the commercial supply of pork is the United States, whose pork exports in 1883 were valued at £1,238,454. Pork possesses much less fibrine, albuminous, and gelatinous matter than beef or mutton, but compensates by its more abundant supply of fat.

POROSITY, the name given to a property possessed by all bodies; it asserts that the particles of bodies are not immediately contiguous to one another, but are separated by intervening spaces or pores. Certain kinds of stone employed in stone-filters allow water to pass through their pores, but prevent the passage of small solid bodies previously held in suspension by the water. The 'Florentine experiment' showed that gold and lead allowed water to pass through their pores. Hollow globes of gold and lead were filled with water, and securely closed; when these spheres were struck with a hammer the pressure within became great enough to force the water through the pores of the metals, making the appearance of dew on the outsides of the vessels. If measurements of volume are taken, when water and alcohol are mixed the volume of the mixture is found to be less than the sum of the volumes of the constituents, the particles having been brought closer together than before. Bodies expand and contract in volume with heat and cold; they can also be compressed by the application of forces, so that their particles cannot be in immediate contact. Iron and platinum when at a high temperature allow gases to pass through them.

That the molecules of bodies are not only separated from one another, but are always in a state of rapid motion, is a theory which is now generally accepted by natural philosophers.

PORPHYRY is a compound rock having a basis in which the other contemporaneous constituent parts are imbedded. The base is sometimes clay-stone, sometimes hornstone, sometimes compact felspar, jade, pitchstone, pearlstone, and obsidian. The imbedded parts are commonly felspar and quartz; the former in more or less distinct crystals. There are porphyries of different ages. One variety is found graduating into granite and gneiss, but this does not possess the characteristics of the rock in the highest perfection; another is found in overlying strata, and unconformable to other rocks, which is the true porphyry. Its colour is often red or green, and when polished it is valuable for ornamental work, being superior to marble on account of its great hardness. This rock abounds in Egypt, the northern parts of Europe, in Mexico, and South America. There is still another variety found in connection with extinct volcanoes, which is sometimes distinguished by the name of *clay-porphyry*. It abounds in the neighbourhood of the Mediterranean.

PORPHYRY (*Porphurios*), a Greek philosopher of the Neo Platonic school, celebrated as an antagonist of Christianity, is called a Tyrian and a Batanean, whence it is conjectured that he was a native of a Tyrian colony at Batanea, the Bashan of Scripture. He was born, as is inferred from his own statements, about 233 A.D. His original name was Malchus, from the Syrophœnician *melech*, king. Longinus, whose pupil he became, gave him the title of Porphyrius, indicative of the purple colour of royal robes. He was early placed under the teaching of Origen, and afterwards studied under Apollonius and Longinus in Athens. At the age of thirty he came for the second time to Rome to place himself under the teaching of Plotinus. Plotinus had deputed the task of initiating new pupils to Amelius. Porphyry at first disputed the doctrine taught him, in a treatise in support of the position 'that the things perceived by the mind exist out of the mind,' which he submitted to Plotinus for reply. Plotinus handed it to Amelius, who wrote a treatise in reply to it; and after some further controversy Porphyry expressed himself satisfied, and read a recantation in the school. This incident is important, as indicating the teaching of Longinus, and possibly by implication of Ammonius, the instructor of Plotinus. Porphyry finished by entirely adopting the opinions and obtaining the confidence of Plotinus, whose literary assistant and executor he became, and upon whom he exercised considerable influence in inducing him to commit his views to writing. Porphyry was naturally of a hypochondriacal disposition, and the abstruse mysticism of Plotinus incited in him a tendency to cherish thoughts of suicide, which Plotinus perceiving recommended to him a change of situation, and about 268 he went to Sicily. Here he is said to have written his treatise against the Christians, which was in fifteen books. It was publicly burned by the Emperor Theodosius, and is only known from fragments in the authors who have refuted him. Porphyry, as well as Plotinus, recognized Christ as an eminent philosopher; but he charged the Christians with corrupting his doctrines. He married, when somewhat advanced in life, a widow with seven children, and a letter is extant which he addressed to his wife. He died about 304 or 306.

The philosophy of Porphyry is completely identified with that of Plotinus, an account of which has been already given. (See PLOTINUS.) Porphyry represented chiefly the religious phase of this philosophy, and we need here only refer to its relation to the popular mythology and theurgy, which has been merely adverted to in the life of Plotinus. The best ancient philosophers found no difficulty in reconciling polytheism with the belief in one supreme and omnipotent God. The conception of created intelligences of an order superior to man furnished a solution of the popular beliefs, which did not contradict their higher speculations. Thus, Socrates had his demon, Plato believed the gods to have been created in a manner similar to man, and Plotinus and Porphyry joined a belief in good and evil demons, and a respect at least for the Greek mythology with their philosophical tenets. These beliefs have been the ground of accusations of inconsistency against Porphyry, who dwells on them occasionally in his writings. He believed, as did Plotinus, in enchantment as a means of acquiring power over demons and the souls of the dead; but he always ranked philosophy higher than mythology, and from his letter to the Egyptian prophet Anebo it appears that at a later

period of his life doubts of the popular theology, and of the theurgical notions associated with it had begun to prevail with him. The practical tendencies of his philosophy were ascetic. He held that all matter was polluted, and that no material sacrifice ought to be offered to the supreme God. With the view of restraining the sensual desires he abstained from animal food, and would also, if it had been possible, have abstained from vegetable diet. He distinguished four degrees of virtue—political virtue, or that of moderation is the first grade; purifying virtue, which sets the soul free from passion, and by means of which men are made to resemble demons, is the second grade; in the third grade, which corresponds with the absorbing devotion to philosophy, man becomes a god; and in the fourth, which answers to the ecstatic state of Plotinus, he becomes the father of the gods. He recognizes a soul in animals, and accords to them a certain amount of intelligence and reason. The scholarship of Porphyry was for his day extensive; but it was entirely subject to the allegorizing and mystical tendencies of the school of philosophy to which he belonged, and he studied the philosophers of other schools, not so much to ascertain their opinions as to find his own in them. Porphyry was a voluminous writer, but comparatively few of his works are extant. The titles of some of them are such as to convey little information to any one not versed in Neo-Platonic philosophy. Besides his editorial work for Plotinus, the most important are his Lives of Plotinus and Pythagoras, the latter supposed to be a fragment of a larger history of philosophers. It is a very partial production, and gives Pythagoras a much higher rank in the history of philosophy than he is entitled to. Among his other works we may mention, Principles concerning Intelligibles, a resumé of the Philosophy of Plotinus, and the Cave of the Nymphs in the Odyssey, a contribution to a symbolical interpretation of Homer. There is no complete edition of the extant works of Porphyry. The Life of Pythagoras was published at Rome (1630); De Abstinentia (Cambridge, 1655); A Fragment on the Organum of Aristotle (Florence, 1521); The Fragment on the Odyssey (Rome, 1518).

PORPOISE, a genus of Whales or Cetacean Mammalia, belonging to the family Delphinidæ (Dolphins, &c.) of that order. The Common Porpoise (*Phocæna communis*) is at once the most familiar and the smallest of the Cetacea, and occurs plentifully off the coasts of Britain and in the North Sea. The nearly-allied Grampus (*P. Orca*) is included in the same genus with the Porpoise. The name Porpoise is derived from the French *porc-poisson*, or 'hog-fish,' and the term has evidently allusion to the black pig-like form and gambols of these forms; the German term *Meerschwein* possessing the same significance, and also the more familiar French name of *Marsouin*. In the Porpoise genus the head is blunt, and does not project anteriorly to form a beak or rostrum, as in the Dolphins. Teeth exist in both jaws, and a dorsal fin exists, being placed far back on the dorsal surface. An allied species is the *P. Melas* (or *P. Globiceps*), the 'Round-headed' Porpoise or 'Ca'aing Whale' of the Shetlanders, which occurs in flocks, and which exemplifies strong gregarious habits. These latter forms are much larger than the Common Porpoise, and measure on an average from 20 to 24 feet in length. The head is very convex and rounded. The 'Ca'aing Whales' inhabit the northern seas, and are hunted for the sake of the oil. They are captured by driving them towards the shore, the entire flock generally following the example of any one member which becomes stranded. The bellowings of these forms are described as being exceedingly loud and noisy. The term 'Bottle-nosed Whale or Porpoise' is sometimes applied to this latter species; the name of whale being of course misapplied when considered with reference to the strict zoological position and relations of the Porpoises.

The Common Porpoise attains an average length of 5 feet. The smooth skin is destitute of hairs, save in the neighbourhood of the mouth in the young state. The front portion of the head is of convex form, and possesses in the middle line the spiracle or 'blowhole,' formed of the united nostrils, and presenting a crescentic shape. The eyes are of small size, and are situated low down on the head, and behind the posterior edge of the mouth or 'gape.' The ear opens close behind the eye, and is of very small size. The genital apertures of the male are placed much anterior to the anus or vent, the intervening space in the female being of smaller size, and containing the teats. As in all the Cetacea the tail or caudal fin is flattened, and placed horizontally or across the body, instead of vertically, as in fishes. The muscles and tissues beneath the skin are invested by a thick layer of blubber and fat. The bones are spongy in texture, and those of the limbs possess no medullary or marrow cavities. The neck, as in other Cetacea, is very short, and its vertebræ are ossified together, the lumbar part of the spine being elongated. The dorsal and lumbar vertebræ together number twenty-eight, the anterior fifteen of these belonging to the back, properly speaking. The skull has a 'flask-like' shape or contour, the jaws being prolonged. The fore limbs naturally project from the body, their flat surfaces being directed upwards and downwards. Six or seven bones exist in the wrist, and the five fingers, commencing with the thumb in order, possess respectively 2, 8, 6, 3, and 2 'phalanges' (which see) or separate bones. Nails are wholly wanting. The pelvic or haunch bones are represented by simple curved bony pieces, which lie imbedded among the muscles and tissues of the abdominal surface of the body. No hind limbs are developed. The teeth are of small size, and are not preceded by milk teeth, their crowns being of blunted shape. The stomach consists of three portions, into the first of which the gullet opens. No cæcum exists, and a gall-bladder is wanting. The spiracle or outer nostril opens into a spiracular chamber, which in turn communicates with the external openings in the skull of the nostrils. These latter openings can be closed at will by valves. The 'blowing' of the Porpoise is caused by the ejection of the air, which has been used in breathing, from the outer spiracle; this air commonly lifting up with it such water as lies above the head and nostrils of the animal before it comes to the surface. Hence the water 'blown' by the Whales and porpoises does not consist, as commonly supposed, of water taken into the mouth and then ejected by the nostrils. By the muscular approximation of the epiglottis and upper part of the windpipe to the soft palate and hinder or mouth openings of the nostrils, the air-passages and nostrils are brought to form one continuous tube, and breathing can thus be performed independently of the swallowing of food or of the opening of the mouth. No olfactory nerves or those of smell exist, and the eye possesses a thick sclerotic or outer coat. The lungs are not divided into lobes, and the lung-tissue itself is of very dense structure. Vocal cords are undeveloped in the Porpoises.

The food of the Porpoises consists of herrings and other fishes, amongst shoals of which they prove very destructive. They commonly follow the herring-shoals, and frequently become stranded in the pursuit of their prey into shallow waters. They gambol in the water after the fashion of the Dolphins, and appear to exist in herds or 'schools.'

PORPORA, Nicolò (called by the Italians the *patriarch of harmony*), was born at Naples about 1685, and studied under Scarlatti, whose favourite pupil he was. His first opera, Ariana e Teseo, was brought out at Vienna, 1717. In 1722 he had composed five operas and an oratorio. The Saxon musician Hasse, who was his pupil for some time, transferred himself to Scarlatti, which caused enmity between these two musicians. In 1725 Porpora went to Vienna along with his celebrated pupil Farinelli; but while the success of the singer was complete, the composer from his too flowery style failed to please the emperor, and discontented with his reception returned to Naples. After professional visits to Rome and Venice he yielded to a pressing invitation from the court at Dresden. He had already composed fifty operas, and was regarded as without a rival. At Dresden an envenomed war of jealousy set in between him and Hasse, who had hitherto reigned supreme there. The victory finally remained with Porpora, who was soon called to encounter a more formidable rival. In 1729 a party in London, which was discontented with Handel, opened a second opera-house, and called Porpora to take the direction of it. Porpora, supported by Farinelli and other distinguished singers whom he had trained, again triumphed, and Handel after a heavy pecuniary loss gave up the theatre, and devoted himself to oratorio. Porpora now gave up his engagements in Dresden, and established himself in London. Here his reputation, especially as a singing-master, continued to be great; but from home-sickness or some other reason unknown he left London, and in 1738 is found at Venice, where he appears to have remained till 1745. One of his pupils, who was the mistress of the ambassador appointed by the republic to Vienna, took him with her to the Austrian capital. Here, in 1754, Haydn, for the sake of obtaining his instructions, became his valet. In 1760 he presided at the production in Naples of his last and feeblest opera, Il Trionfo di Camillo. His fame had long been declining, and although he had trained, besides Cafarelli and Farinelli, many more of the leading singers of the day, whose talents brought them large revenue, he was left to die in great poverty. Only a few of his operas are now known, and none of them have retained popularity; but he is regarded as the most accomplished singing-master who has ever existed. His religious compositions, and especially his cantatas, are the works in which he exhibits himself to most advantage. He died at Naples in 1767.

PORSENNA, or Porsena, Lars, the king of the Etrurian city Clusium, according to the legend narrated by Livy, received the Tarquins when they were expelled from Rome, and after in vain endeavouring to effect their restoration by negotiation, advanced with an army to Rome. He would have entered the city with the flying Romans had not Horatius Cocles disputed the passage until the bridge was broken down. Porsenna then besieged Rome, and a famine was produced in the city, when another Roman youth, Mucius Scævola, gave a striking proof of his patriotism and devotedness. (See Mucius Scævola.) Porsenna was now inclined to negotiation. He demanded that their property should be restored to the Tarquins, and that the cities taken from the Veientes in former wars should be given up. The second condition was granted; the first was rejected. A truce, however, was agreed upon, for the security of which the Romans sent ten young men, and as many girls, as hostages to the Etrurian camp. The latter found an opportunity of escaping to Rome by swimming over the Tiber. But the consul Publicola conveyed them back again to Porsenna, and was on this occasion treated with the greatest indignity by the Tarquins. Porsenna on receiving intelligence of it immediately despatched his son Aruns to protect the Romans. Indignant at the perfidy of the Tarquins, and respecting the magnanimity of the Romans, the king separated himself from the former, and concluded peace with the latter without taking away their hostages. To relieve the wants of the Romans without offending their pride by a formal present, he left behind at his departure his whole camp with all its stores. In remembrance of his magnanimity the senate erected to him a monument, and presented him with an ivory chair and sceptre, a golden crown, and a royal robe. A subsequent proposition from Porsenna to the Romans to admit the Tarquins being declined, Porsenna abandoned them, lived in undisturbed friendship with the Romans, and restored to them the territory of the Veientes, which they had ceded at the conclusion of peace. Modern critics have held that Rome was completely conquered by Porsenna, and that the gifts they are represented as offering from gratitude were really a tribute indicating subjection. Aruns, the son of Porsenna, was defeated by a league of the Latin cities, after which the Romans are believed to have recovered their independence. The critics who give this interpretation to the legend do not accept the motive assigned to Porsenna of restoring the Tarquins. K. O. Müller, indeed, supposes that it was Porsenna, and not the Romans, who expelled them. According to Pliny Porsenna forbade the Romans the use of iron, except for agricultural purposes.

PORSON, Richard, a celebrated critic and classical scholar, professor of Greek in the University of Cambridge. He was born, December 25, 1759, at East Ruston, in Norfolk, where his father was clerk of the parish, and to him he was indebted for the first rudiments of his education. He received some further instruction at the village school, and also from the vicar of Ruston; after which he was sent to Eton, through the patronage of some gentlemen who witnessed and admired his early proficiency and inclination for the study of classical literature. In 1777 he became a student of Trinity College, Cambridge, where he gained a prize medal, and in 1781 he was chosen to a fellowship. He took the degree of M.A. in 1785, and not choosing to take holy orders, on account of conscientious scruples in regard to the signing of the Thirty-nine Articles, he was obliged to relinquish his fellowship. In 1793 he was unanimously elected Greek professor, and two years after he began the publication of the Tragedies of Euripides, with annotations, but continued his labours only through four of these dramas—Hecuba, Orestes, Phœnissæ, and Medea. He also assisted in editing the Grenville Homer, published at Oxford (1800, four vols. 4to), and corrected the text of the tragedies of Æschylus for a splendid edition, which issued from the Glasgow press in folio, also printed in two vols. 8vo. He enjoyed the reputation of being one of the best Greek scholars and critics of the age, notwithstanding which he experienced little patronage, a circumstance partly attributable to his intemperate habits. In 1805 he was appointed librarian to the London Institution, with a salary of £200 a year, and his death took place September 25, 1808, at his apartments in the house then belonging to that establishment in the Old Jewry. His decease was occasioned by apoplexy; and his body having been subjected to anatomical examination, it was discovered that his skull was one of the thickest that had ever been observed. He was the author of Letters to Archdeacon Travis, in Answer to his Defence of the Three Heavenly Witnesses (1790, 8vo), in which he is allowed to have proved that the received text of 1 John v. 7, 8 is

spurious; and after his death Professor Monk and C. J. Blomfield, afterwards bishop of London, published his Adversaria, or Notes and Emendations of the Greek Poets; and his Tracts and Miscellanies were edited by the Rev. Thomas Kidd (1815). Many of these are sallies of irony and humour of the most racy and peculiar kind, which, with other articles abounding with learning and critical acumen, appeared in various of the literary journals. Acuteness of discernment, solidity of judgment, united to intense application and a stupendous memory, rendered Professor Porson a complete critic in the most honourable sense of that appellation.

PORT. The name of *Port wines*, or *Oporto wines*, is given, in commerce, to the produce of the vineyards along the course of the Douro, in Portugal. Port is naturally a very rich and delicate wine, varying in colour from a pale rose to a deep red. The harvest lasts from the beginning of September to the middle of October. The wines are divided into two great classes—the *vinho de embarque*, the best or export wine, which grows on the heights and slopes, and the *vinho beamo*, the wine of the plains, which is drunk in the country. The wines for export are very much mixed, and are strongly fortified with brandy, partly to make them sooner ready for export, and partly to suit the taste of the foreign markets, particularly England; but of late years brandied wines have been rather declining in popularity there. The mixing of the various wines considerably reduces the variety of qualities of port exported, compared with those which are naturally produced. A mixture called *jeropiga*, consisting of elder-berries, molasses, and raisin juice is added with the spirit, especially to the lower qualities of the wine, to give the uniformity of colour which is deemed desirable. The wine is first placed in large tuns, in which it remains till winter, when it is racked into pipes, and conveyed to Oporto. To that intended for exportation brandy is added when it is deposited in the stores, and an additional quantity when it is shipped, generally about a year after the vintage. Port wines of excellent quality are often so highly adulterated with brandy as to be entirely deprived of their flavour and aroma; and the stronger kinds, which are not irretrievably ruined by this admixture, only regain their flavour after being allowed to mellow for many years. When the colouring and extractive matter is deposited with age and forms a crust, the colour of port becomes a deep tawny brown. The English market has always been the principal market for port wine, and the praises of English connoisseurs have tended more than anything else to spread its fame in other countries. The taste for this wine was introduced into England soon after the close of the attempts of the English to maintain a footing in France, and it soon began to supersede the Bordeaux wines, which, up to this time, had supplied the English markets. In the seventeenth century English establishments were formed in Oporto to direct the purchase and shipping of the wines. These companies eventually united into a sort of corporation called the English Factory, which became completely master of the market. In the following century the Marquis of Pombal organized an association of producers to oppose this monopoly of buyers. Until 1852 the export trade was under the despotic rule of this company, and was subject to a heavy export duty. After the abolition of the company the control of the trade was given to a committee of taste. Since 1865 it has been left free, and the wine which has come from Portugal since that date has been of more genuine quality than formerly.

PORT, a harbour or haven on the sea-coast. *Free port* is one at which the goods imported are exempted from the payment of any customs or duties, as long as they are not conveyed into the interior of the country. *Free port* is also used for a total exemption and franchise which any set of merchants enjoy for goods imported into a state, or those of the growth of the country exported by them.

PORT, the name given by admiralty order to the larboard or left side of the ship (looking towards the prow), as *port the helm*—the order to move the tiller so as to turn the rudder to the starboard side of the stern-post. This word is intended to prevent any mistakes happening from the similarity of sounds in the words *starboard* and *larboard*.

PORT, or PORT-HOLE. The embrasures or openings in the side of a ship of war, wherein the artillery is ranged in battery upon the decks, above and below, are called *ports*, or *port-holes*.

Gun-room ports are situated in the ship's counter, and are used for stern chases, and also for passing a small cable or a hawser out, to moor head and stern, to tow a ship, or to spring upon the cable.

Port-lids, a sort of hanging doors to shut in the ports at sea. They are fastened by hinges to the upper edges of the ports, so as to let down when the cannon are drawn into the ship, whereby the water is prevented entering the lower decks.

Port-hooks, hooks over the ports, to which the port-hinges are attached.

PORTADOWN, a market town, Ireland, in the county and 9 miles north-east of Armagh, a station on the Ulster Railway, on the Bann, here crossed by a handsome bridge. Its principal buildings are the railway-station, an Episcopal church, a Roman Catholic chapel, and other places of worship. It has also a National and other schools, and a benevolent society; large corn and flour mills; manufactures of linen and cambric, of steam-engines and other heavy machinery; a soap and candle work; and a brisk trade in corn, pork, butter, and general farm produce. Pop. 7850.

PORTAL CIRCULATION, the distribution of venous blood collected from the spleen, stomach, intestines, and mesentery, throughout the liver by the *portal vein*. This peculiar circulation is distinctly and exclusively characteristic of Vertebrate animals, no Invertebrate possessing a circulation of this kind. The blood thus sent by the portal vein to the liver constitutes a secondary distribution of blood to that organ, the primary distribution being one of pure or arterial blood conveyed to the organ by the hepatic artery, and intended for the due nutrition of the liver. The portal blood supplied to the liver constitutes the chief source from which that organ by means of its peculiar structure secretes the *bile*. (See LIVER.) The portal vein branches out and distributes itself in the liver much after the fashion of an artery, as described in the article LIVER. The branches of the portal vein are peculiar in that they are unprovided with valves, and the blood of the portal vein is finally returned into the *inferior vena cava*. The portal blood derived from the stomach, spleen, &c., is generally of lower specific gravity than ordinary blood. It contains more water and albumen and fewer red corpuscles. Its clot is also less firm than that of ordinary blood.

PORT-AU-PRINCE, capital of the Republic of Hayti, on the western side of the island, at the south-east extremity of the bay of the same name, lat. 18° 33′ N.; lon. 72° 27′ W. Under the régime of the French Republic it received the name of Port-Republicain. It is built in a low and unhealthy spot, with broad but unpaved and dirty streets, consists chiefly of wooden houses of two stories, and contains an ungainly palace, a senate-house, a handsome Roman Catholic church, a custom-house, mint, an

hospital, public offices, &c. The educational institutions are a lyceum, and several other schools. The shipping trade is considerable, the chief exports being mahogany and red wood, coffee, and cocoa-nuts. The trade is chiefly with North America, England, and France. The city was founded in 1745, and was completely destroyed by an earthquake in 1770. It has also several times been ravaged by fires, as in 1791, 1843, and 1867. Pop. estimated at 35,000.

PORTCULLIS, in fortification, is an assemblage of several large pieces of wood, joined across one another like a harrow, and each pointed with iron at the bottom. They are sometimes hung over the gateway of old fortified towns, ready to be let down in case of surprise, when the gates cannot be shut.

PORTE, Ottoman, or Sublime Porte, the common term for the Turkish government, which has entered the English language through the French, and is derived from the oriental custom of holding court at the gate of the palace, or at the gate of a city.

PORT-ELIZABETH, a seaport town, South Africa, Cape Colony, on the west shore of Algoa Bay, 18 miles south-east of Uitenhage, of which it is the port. It has an arsenal, a fine Episcopalian church, and places of worship for Wesleyans, Independents, and Roman Catholics; a handsome town-hall, custom-house, hospital, educational institute, jail, &c. The pier projects into the sea, and the port, being free, is a place of great and increasing commercial activity, and more frequented than any other on the south coast of the colony. The exports and imports each amount to considerably more than a million sterling. Pop. probably about 15,000 to 20,000; by census of 1875, 13,049.

PORTER. See Brewing.

PORTER, the name of two talented sisters, of which, however, the elder, Jane, was the most distinguished. They were sisters of the celebrated traveller Sir Robert Ker Porter, and were natives of Durham. Jane Porter was born in 1776, and made her first essay in literature in 1803, by the publication of Thaddeus of Warsaw, a historical romance, which became extremely popular, and procured her admission as a canoness into the Teutonic order of St. Joachim, and a complimentary letter from Kosciusko. A still greater success attended her Scottish Chiefs, which appeared in 1809. A succeeding generation, however, has not confirmed the verdict of their fathers on this work, as though well and vigorously written in point of description and character, it gives a very erroneous representation of the condition of the country at the time. Her subsequent works were the Pastor's Fireside; Duke Christian of Luneburg; Tales Round a Winter's Hearth, in which her sister, Anna Maria, took a part; the Field of Forty Footsteps, founded on a London legend; and Sir Edward Seaward's Diary, published anonymously in 1831. In the last she imitated so closely the style and manners of the period, that for some time it was doubted whether it was a fiction or not. She died at Bristol in 1850.—Anna Maria Porter was born about 1781; lost her father when only a few months old; and before she was fifteen, published two volumes entitled Artless Tales, a proceeding, however, which she afterwards regretted. The greater part of her life was spent with her mother and sister Jane in the neighbourhood of London. She contributed extensively to various periodicals, and produced numerous novels, which enjoyed considerable popularity in their day. They include The Hungarian Brothers, Don Sebastian, The Recluse of Norway, The Fast of St. Magdalen, and The Knight of St. John. She is also the author of Tales of Pity, and a volume of poetry entitled Ballad Romances and other Poems. She died June 21, 1832.

PORTER, George Richardson, an eminent statist, was born in London in 1792, and educated in the Merchant Tailors' School. He followed his father's profession, that of a sugar merchant, but was unsuccessful in business. He resolved to turn the knowledge which he had acquired of commercial matters to account in a literary point of view, and he accordingly published in 1830 a Treatise on the Cultivation of the Sugar-cane. Subsequently to this he wrote a Treatise on the Silk Manufacture, and another on the Manufacture of Porcelain and Glass, for Lardner's Cabinet Cyclopædia. A paper on Life Assurance, contributed by him to the Companion to the Almanac for 1831, obtained for him, through Mr. Knight, an appointment in connection with the board of trade. The duties of the office consisted in arranging and condensing into a compendious form the huge array of detached facts and statements contained in the blue-books and parliamentary returns. These were so satisfactorily executed by Mr. Porter, that on the statistical department of the board of trade being organized, he was placed at its head; and in 1841 was made one of the secretaries of the board, with a salary of £1500 a year. His great work is the Progress of the Nation in its Social and Commercial Relations from the Commencement of the Nineteenth Century to the Present Time, first published in 1836–38 (new edition, three vols., crown 8vo, 1847). He took a prominent part in the establishment of the Statistical Society, and also as a member of the British Association for the Advancement of Science. In 1850 he produced, in connection with Mr. Long, the Geography of Great Britain, part I., England and Wales, issued by the Society for the Diffusion of Useful Knowledge. His sedentary life, however, injured his health, and induced a bad habit of body. The sting of a gnat on his leg gave rise to an inflammation which terminated his existence at Tunbridge Wells, on 3d September, 1855.

PORTER, Sir Robert Ker, an eminent artist and traveller, was born at Durham about 1775. His mother was left a widow with five children, and in poor circumstances. Robert early manifested an uncommon genius for drawing, many of his sketches, made when he was only six years of age, being remarkable for their spirit; and in 1790 he became a student at the Royal Academy, under the auspices of Benjamin West. Not more than two years had elapsed since his commencing his studies at the Academy, when he was employed to paint the figures of Moses and Aaron for the communion-table of Shoreditch Church. In 1794 he presented to the Roman Catholic chapel at Portsea an altar-piece representing Christ calming the storm; and in 1798 he gave to St. John's College, Cambridge, an altar-piece, the subject of which is St. John preaching in the wilderness. He was only twenty-two when he began his large picture of the storming of Seringapatam. Though it contained nearly 700 figures as large as life, it was finished in ten weeks; nor did it bear any marks of haste, it being, both in composition and colouring, a work of high merit. It was succeeded by two other pictures of the same magnitude—the Siege of Acre and the Battle of Agincourt. In 1804 he was invited to Russia by the emperor, who made him his historical painter. He consequently visited St. Petersburg, where he was received with distinction, and employed to decorate the admiralty hall in the Russian capital. While residing there he gained the affections of the Princess Sherbatoff, and was on the point of marrying her when a rupture with Britain obliged him to leave Russia. He passed into Sweden to join the British forces under Sir John Moore, whom he accompanied to Spain, sharing in the hardships and perils of the

campaign, which ended with the battle of Corunna. After having remained for some time in Britain he again went to Russia, and received the hand of the Princess Sherbatoff. With her he revisited his native country, where, in 1813, he obtained the honour of knighthood. From 1817 to 1820 inclusive he was engaged in travelling through the East. In 1832 he was created K.C. of Hanover. Being British consul to Venezuela in 1826–41, he resided at Caracas till 1841, when he paid a visit to St. Petersburg. Here he died, May 4, 1842, aged 61. Among his works are Travelling Sketches in Russia and Sweden (two vols. 4to, 1808); Letters from Portugal and Spain (8vo, 1809); Narrative of the Campaign in Russia (1813); Travels in Georgia, Persia, and Armenia (1822).

PORT-FIRE, a stick of a combustible composition, generally burning an inch a minute, used to convey fire from the slow match to the priming of ordnance. For this purpose it is now generally superseded by other arrangements. With a slightly altered composition it is used for signals, and for firing charges of mines.

PORT-GLASGOW, a seaport town in Renfrewshire, situated on the southern bank of the estuary of the Clyde, 20 miles W.N.W. from Glasgow, and about 2½ farther up than Greenock. The ancient village of Newark is incorporated with Port-Glasgow. The whole is built on a regular plan, the streets crossing each other at right angles. The town-house, court-house, and prison combined form a fine range of buildings, with a Doric portico and a handsome spire; among the places of worship the parish church and the Episcopal church deserve special mention; there is also a handsome town-hall and a good custom-house. In 1662 the magistrates of Glasgow purchased 13 acres of land from Sir Robert Maxwell, near the village of Newark, on which they built harbours and the first dry dock in Scotland. The place was intended to be the seaport of Glasgow. In 1668 they got a charter from Charles II. to erect Port-Glasgow into a barony, with civil and criminal jurisdiction, and the place made rapid progress. In the year 1835, though the business of the place had been some time on the decline, the tonnage of vessels frequenting the port was still about 12,000 tons. At that time, when the Clyde was deepened so as to enable large vessels to sail up to Glasgow, the trade of Port-Glasgow rapidly diminished. It has recently somewhat revived. In 1882–83 the largest revenue ever drawn was announced by the Harbour Trust. In 1882 71,164 tons of shipping arrived. In the same year there belonged to the port eighteen sailing vessels, of 8570 tons, and fifteen steamers, of 2654. The staple industries are shipbuilding and marine engineering; and there are manufactures of sail-cloth, ropes, &c. The Caledonian Railway has a station at Port-Glasgow. The burgh joins with Kilmarnock, Rutherglen, Dumbarton, and Renfrew in sending a member to Parliament. Pop. in 1881, 13,264.

PORTICI, a town in Southern Italy, extending along the Gulf of Naples at the base of Vesuvius. It is distant 5 miles from the city of Naples, but to a stranger appears to be really a suburb of that city, being connected to it by the intervening village of S. Giovanni a Teduccio. It is delightfully situated, and from its proximity to Naples has many elegant villas, and is surrounded by fine country seats. It possesses a royal palace built upon the lava of 1631 by Charles III. Here were deposited the objects of art discovered at Pompeii and Herculaneum, now added to the collections in the museum at Naples. The palace has lately been made over to the municipality of Naples. On the gulf is a fine square, below which is the harbour, formed by a mole, and defended by a castle. Here an active fishery is carried on. Pop. 9777.

PORTICO (Italian, from Latin *porticus*), a continued range of columns, covered at top in order to serve as a shelter from the weather; also the space inclosed by the columns at the entrance of a building. Among the ancients these were highly ornamented, and of great extent. The remains of the Portico at Palmyra show it to have been full 4000 feet long. There was a famous portico at Athens, called *Pœcile*. Among modern porticoes those of the grand façade of the Louvre and of the great court of the Hospital of Invalids at Paris, and that at Greenwich Hospital, deserve mention.

PORTIUNCULA. See FRANCISCANS.

PORT JACKSON. See SYDNEY.

PORTLAND, a seaport town in the United States of America, in Maine, 100 miles N.N.E. of Boston, on a peninsula at the western extremity of Casco Bay, at the southern extremity of the Atlantic and St. Lawrence Railway. The ground, rising into two heights at its eastern and western extremities, forms a natural amphitheatre, and gives to the town, which is built upon it, more especially when it is approached from the sea, a beautiful appearance. It is laid out with considerable regularity, at least in the more modern portions; and the main street, extending along the ridge of the peninsula east to west, is not surpassed by many in the Union. Few of the churches can boast of possessing much architectural merit; other buildings are the court-house, the city hall, the custom-house buildings, used also for the post-office and court-rooms; the Athenæum, and the Mechanics' Hall. The largest manufacturing establishment is a factory in which locomotives, cars, &c., are made; there are also shipbuilding yards, glass-works, potteries, and rope-walks; and the refining of petroleum and sugar is extensively carried on. The trade both maritime and inland is extensive. The harbour is one of the best in the United States, being of easy access, capacious, safe, deep enough for the largest vessels, and rarely obstructed with ice. There are two dry docks and other facilities for the repair of vessels. The value of the imports from foreign countries in 1882 was £1,471,199, that of the exports being £1,706,062, both of these amounts being considerably lower than in previous years. The greater part of the carrying trade to and from foreign parts is in British ships. The coasting trade is extensive, and many vessels are engaged in the fisheries. The principal exports are timber, fish, beef, butter, &c. Portland was settled in 1632, but was nearly destroyed by the Indians in 1675. It suffered severely during the revolutionary war from a bombardment by the British fleet in 1775. The city is considered remarkably healthy, and in its immediate vicinity there are many fine seaside summer resorts for its numerous visitors during the season. Pop. in 1880, 33,810.

PORTLAND, the chief city of Oregon, United States, situated on the left bank of Willamette River, about 12 miles from its confluence with the Columbia. The city is the terminus of the Northern Pacific railway system, and is at the head of ship navigation, having regular steam communication with British Columbia and San Francisco. Among its public buildings are a court-house, custom-house, numerous churches, several academies, high-class and common schools, lunatic asylum, &c. There are also iron-foundries, machine-shops, flour-mills, breweries, and other manufacturing establishments. Wheat, oats, flour, wool, and lumber are largely exported. Pop. (1880), 17,577.

PORTLAND, ISLE OF, a peninsula, supposed to have been formerly an island, in the south of England, county of Dorset, 50 miles W.S.W. of South-

ampton, in the British Channel, forming the western boundary of Weymouth Bay. It is attached to the mainland by a ridge of shingle, called the Chesil Bank, about 10 miles long. It consists of nearly one mass of freestone, called Portland stone, which is exported in great quantities, and is about 4 miles long by 1½ mile broad, and terminates at its southern extremity in the point called Portland Bill. On the north side, opposite to Weymouth, is the only landing-place on the peninsula, the rest being surrounded by high, inaccessible cliffs. The land is under excellent cultivation, or is kept as pasture for sheep. Fish abound along the coast, particularly mackerel. One of the most prominent objects in the island is the convict prison, situated on the top of a hill. It is a building of wood and iron, so as to be removable. It contains about 1500 convicts, who are chiefly employed in working the quarries.

PORTLAND BREAKWATER, the greatest work of the kind in Britain, runs from the east side of Portland Island in a north-east direction, with a bend towards Weymouth, and forms a complete protection to an extent of 6745 acres of water—namely, 2107 acres from low-water up to depth of 12 feet, 1758 between 12 and 19 feet, 1590 between 3 and 5 fathoms, and 1290 outside the 5 fathom line. The breakwater is built in 9 to 10 fathoms of water. It is founded on rubble stones, surmounted by an ashlar superstructure with a parapet. It consists of a sea-wall 100 feet high from the bottom of the sea, 300 feet thick at the base, and narrowing to the summit. Its entire length is 1⅝ mile, consisting of an inner breakwater 1900 feet in length, and an outer of 6200 feet in length, forming an obtuse angle, and divided by an opening 400 feet wide, through which ships can pass straight to sea with a northerly wind. It is protected by a circular fort at the north 100 feet in height, 400 feet in diameter at the base, and 200 at the summit, standing in a depth of 60 to 70 feet of sea-water. The lower story is reserved for stores; the upper one will mount fourteen 38-ton guns. There is also a circular fort at the east end. The inner breakwater has a roadway with arched recesses in which stores are lodged. The pier is carried above the level of high-water at spring-tides. The entire work has occupied a period of nearly twenty-five years, and has cost £1,033,600, exclusive of convict labour to the value of probably £400,000. It is constructed of stone, quarried by the convicts in the island of Portland.

The first idea of the breakwater is due to John Harvey, postmaster, Weymouth, who urged it upon the admiralty in 1794. A commission of inquiry into harbours of refuge appointed in 1846 finally reported in its favour, after a survey by James Rendell, C.E. An act of Parliament (10 and 11 Vict. cap. xxiv.) was obtained, 11th May, 1847, and the preliminary works begun in August, with Rendell as engineer-in-chief. On his death in 1856 he was succeeded by Mr. (afterwards Sir John) Coode, who had hitherto acted as resident engineer. The first stone was lowered into the sea on a signal from Prince Albert, 25th July, 1849; the last stone was laid by the Prince of Wales, 10th August, 1872. The work was begun under the superintendence of the board of trade, and finished under that of the admiralty, to which it had been transferred some years before its completion.

PORTLAND CEMENT, an artificial cement prepared by mixing burned limestone with clay, and heating the mixture. The mud from the delta of rivers is now usually employed; it is mixed with an equal weight of powdered limestone, the mixture is dried in the air, and then burned in a shaft-oven. When mixed with water this cement soon stiffens, and after a day it is tolerably hard. At the end of a month it forms a substance so hard and firm as to emit a sound when struck. See CEMENTS.

PORTLAND STONE is an oolitic limestone occurring in great abundance in the island of Portland, and largely excavated for building purposes. It is used in considerable quantity in the metropolis. The finest stone is found in the lowest strata.

PORTLAND (or BARBERINI) VASE. This beautiful specimen of Greek art is a cinerary urn found in a marble sarcophagus at Monte del Grano, near Rome, during the pontificate of Urban VIII. (1622–44). It is formed of a transparent substance of a dark blue colour, and is ornamented with relieved figures in white enamel. It is 10 inches high, 7 in diameter at the broadest part, and is furnished with a handle on each side. It was placed in the Barberini Palace, where it remained till 1770, when it was purchased by Sir William Hamilton, from whose possession it passed into that of the Duchess of Portland. In 1810 the Duke of Portland gave it on loan to the British Museum, of which he was a trustee. In 1845 a stupidly malicious fellow, or more probably a lunatic, who had been admitted to the museum as a visitor, deliberately smashed it with a stone. It has been repaired, but is not exhibited to the public.

PORTLAW, a manufacturing village in Ireland, county of Waterford, and 9 miles W.N.W. of the town of Waterford, on the Clodagh. It has several churches, dispensary, reading-room, National school, and extensive cotton-factories. Pop. 3774.

PORT-LOUIS, the capital of the island of Mauritius, on the north-west coast, beautifully situated in a cove formed by a series of basaltic hills, portions of which are woody; they vary in height from 1058 to 2639 feet. The streets are rather narrow; they are laid out at right angles, with basaltic curbstones, and are adorned with magnificent acacias. A mountain stream traverses the town, the borders of which are ornamented with plants. An open space like a race-course, called the Champ de Mars, lies behind the town. It is bordered by several elegant villas. There is a barrack, bazaar, theatre, public library, botanic garden, and an hospital. The town and harbour are protected by batteries. Pop. (1881), 70,000.

PORT-MAHON. See MAHON.

PORT-NATAL, or DURBAN, the only port of the colony of Natal, situated in the Bay of Port-Natal, the principal harbour of the colony. It has a botanic garden, horticultural society, natural history, political, and benevolent associations. It has a considerable trade. Pop. 5581.

PORTO-ALEGRE, a town in Brazil, capital of the province of Rio Grande do Sul, near the north-west extremity of Lake Patos and the confluence of the Cahi, Sinos, and Gravatahi with the Jacuhi, 150 miles N.N.W. of Rio-Grande. It is well and regularly built, but only the principal streets are paved. It has several elegant churches, a custom-house, hospital, lyceum, in which Latin, mathematics, philosophy, and rhetoric are taught; and various primary schools; a harbour much visited by merchant vessels, and an important trade. Pop. 15,000.

PORTOBELLO, a parliamentary borough of Scotland, in the county and 3 miles east of the city of Edinburgh, on the Frith of Forth and the North British Railway. It has Established, Free, United Presbyterian, Independent, and Roman Catholic churches, three mission stations, and other religious and charitable institutions; an excellent town-hall, and several academies and schools. It has extensive potteries, brick and tile works, bottle-works, and a paper-mill. It is much frequented as a summer resort from all parts. The beach is well adapted for bathing. The promenade is nearly a mile long, and

the pier, built in 1871, at a cost of £10,000, is 1250 feet long and 22 feet broad, with a restaurant and a saloon at the sea-ward end. Portobello is one of the Leith parliamentary district of boroughs. Pop. (1881), 6926.

PORTO-BELLO, or PUERTO-BELLO, a seaport town in the United States of Colombia, province of Panamá, on the Caribbean Sea, 40 miles N.N.W. of Panamá. It has a fine harbour, discovered by Columbus in 1502. The town, founded in 1584, was for some time the rival of Panamá; but its unhealthy climate caused it to be greatly deserted, and it is now a poor and miserable place, although its fine harbour still attracts some trade.

PORTO-CABELLO, or PUERTO-CABELLO, a town of Venezuela, on the Caribbean Sea. It is built partly on a small island which communicates with the continent by a bridge. It has a capacious and safe harbour, and a population of 7500.

PORTO-MAURIZIO, a seaport town in Italy, province of Maurizio, 40 miles E.N.E. of Nice, on the south-western shore of the Gulf of Genoa. It has several churches, a Capuchin convent, public schools, an hospital, and theatre. The harbour is defended by a mole, but is very incommodious and shallow. It has, however, a considerable trade, especially in olive-oil, of excellent quality. Pop. 6207.

PORTONOVO, a seaport town in Hindustan, in the Carnatic, in the province and 32 miles south of the town of Pondicherry, formerly a large and wealthy town, but now comparatively poor and depopulated, though still occupying a great extent of space. Large vessels anchor at some distance from the town.

PORTO-RICO (Spanish, *Puerto Rico*), one of the Spanish West India Islands, the fourth in size of the Antilles, east of Hayti and west of the Virgin Islands; lat. (south-west point) 17° 56′ N.; lon. 67° 10′ W.; area, with small subordinate islands, 3596 square miles. A range of lofty mountains, covered with wood, runs through the island, east to west, averaging about 1500 feet in height; its loftiest peak is 3678 feet high. In the interior are extensive savannahs, on which numerous herds depasture; and along the coasts tracts of level, fertile land, varying in some places from 5 miles to 10 miles wide, but in others the mountains approach much closer to the sea. Nearly the whole of the north coast is lined with navigable lagoons, some of them 10 miles long, and many of the rivers can be navigated to the foot of the mountains, a distance of 5 or 6 miles. There are numerous bays and creeks, deep enough for vessels of considerable burden; but the north coast is subject to tremendous ground seas, which beat against the cliffs with great violence. Only three harbours are safe all the year round, namely, Guanica and Hovas on the south coast, and San Juan on the north. There are no serpents or other reptiles on the island; but numerous large rats often do great injury to the sugar-cane. The climate is generally more salubrious than that of the other islands of the Antilles. Gold is found in small lumps and in dust, in the streams flowing from the heights. Copper, iron, lead, and coal have also been found; and there are salines or salt-ponds. Porto-Rico is wholly an agricultural island; its products being sugar, rum, molasses, coffee, cotton, excellent tobacco, hides, live-stock, dye-woods, lignum-vitæ, and timber, ground provisions, rice, salt, &c. The exports in 1882 amounted to £2,316,476; and the principal of these were sugar, £1,086,348; coffee, £776,256; tobacco, £152,276; and molasses, £230,516. The imports for the same year amounted to £2,963,096, a large proportion of which is shipped from Great Britain. The commercial prosperity of the island suffers considerably from arbitrary and oppressive taxation. The capital of the island is San Juan de Porto-Rico. There are numerous other towns and villages, but all of them are small. The laws of Spain, as administered in Cuba, are those of Porto-Rico. Slavery was abolished in 1873. The island was discovered by Columbus in 1493. It was invaded in 1509 by the Spaniards from Hayti, who exterminated the natives, 600,000 or 800,000 in number in a few years. Pop. (1878), 410,861 whites; total, 729,445.

PORTO-RICO, SAN JUAN DE, the principal city and seaport of the above island, on its north coast. It stands upon a small island connected with the mainland by a bridge, and is surrounded by strong fortifications. It has six churches and chapels, the bishop's palace, a military hospital, theatre, town-house, jail, house of correction, custom-house, arsenal, &c.; and is the seat of the government and superior courts of the island, of a society of arts, and numerous schools. The harbour is very spacious, and capable of accommodating ships of the largest size. Pop. 18,132.

PORTO SANTO, a small island about 40 miles north-east of the island of Madeira, of which it is a dependency. It is 6 miles long, 2½ broad, and produces wine, oranges and other fruits, vegetables, &c. It was for some time the place of residence of Columbus, after his marriage, his wife having property in the island.

PORT-PATRICK, a village and seaport in Wigtonshire, Scotland, on the shore of the Irish Sea, forming the nearest point of Great Britain to Ireland, the distance here between the two islands being only 21 miles. The harbour was formerly small and inconvenient, being a mere inlet between projecting ridges of rock, but has been much improved, and there is now also a fine quay with a lighthouse. Steamboats, with the mail-bags and passengers, used to pass regularly between this port and Donaghadee, in Ireland, but this has been discontinued since 1849, and the place has sunk into insignificance. A submarine electric telegraph has been laid between the two places. Pop. in 1881, 591.

PORT-PHILLIP, Australia. See VICTORIA.

PORTREE, a village of Scotland, in the county of Inverness, on a small bay on the east shore of the island of Skye, opening at Rasay Sound. It has a parish church, a parochial school, and a good harbour, which is regularly visited by Glasgow steamers, and at which there is a considerable export of cattle, salmon, &c. Pop. (1881), 893.

PORT REPUBLICAIN. See PORT-AU-PRINCE.

PORT-ROYAL, a fortified town on the south-east coast of Jamaica, on the extremity of a tongue of land, forming the south side of the harbour of Kingston. Its harbour is the station for the British ships of war, and it contains the naval arsenal, hospital, &c. The bulk of its inhabitants are people of colour. It has been often damaged by earthquakes. Pop. 15,000.

PORT-ROYAL, a Cistercian convent in France, which played an important part in the Jansenist controversy. This celebrated convent was founded in 1204 by Matthieu de Montmorency. It was situated near Chevreuse (department of Seine-et-Oise), about 15 miles south-west of Paris. It was placed under the rule of St. Bernard. The original name of the site was Porrais or Porrois; this was transformed first into Port-du-roi, then into Port-Royal. Port-Royal, like many other religious houses, had declined from its original severity and fallen into very degenerate habits, when in 1609 the abbess Jacqueline-Marie-Angélique-Arnauld undertook its reform. The number of the nuns increased considerably under her rule, and in 1625 it amounted to eighty. The building had become insufficient, and the insalubrity of the situation induced them to seek

another site. The mother of the abbess undertook the charge of the translation. She purchased and presented to the nuns the house of Cluny, situated at the extremity of the Faubourg Saint Jacques in Paris, to which a body of the nuns at once removed. The old site was subsequently improved by drainage, and a new house built on a higher and healthier situation. The two sections of the convent thus divided were now distinguished as Port-Royal des Champs and Port-Royal de Paris. About 1636 a group of eminent literary men of decided religious tendencies, mostly the relatives of the abbess, took up their residence at a house called Les Granges, near Port-Royal des Champs, where they devoted themselves to religious exercises, manual and literary labours, the education of youth, and the preparation of educational works. These were regarded as forming a joint community with the nuns of Port-Royal, among whom most of them had relatives, and who in most matters followed their counsels. Among those who selected this retirement were Antoine Arnauld, Arnauld D'Andilly, Lemaistre de Sacy and his two brothers, the first two being brothers, the last three nephews of the abbess; Nicolle, and subsequently Pascal, whose sister Jacqueline was a nun of Port-Royal. These men founded here an eminent educational institution, which flourished till 1660, and became a powerful rival to the institution of the Jesuits, and as they adopted the views of Jansenius, which were subsequently condemned by the pope, a formidable quarrel ensued, in which the Port-Royalist nuns, siding with their male friends, became subject to the relentless persecution of the Jesuits, which culminated in the complete subversion of their institution. Port-Royal de Paris had, in the meantime, been growing rapidly in wealth and influence. It was patronized by many persons of high rank at the court, some of whom made it their last retreat and bequeathed their means to it. It was under the direction of the Abbé de Saint Cyran (Duvergier de Hauranne), whose hostility to the Jesuits led, during the last days of Richelieu, to his imprisonment in Fort St. Vincennes. During the wars of the Fronde the house in the country exercised a liberal hospitality. Its protection was much sought and its church was quite filled with cattle and stores deposited for safety, so that it was compared to Noah's ark. The history of the struggle in which the two convents of Port-Royal successively succumbed to their formidable foes is too long and too much involved in questions of ecclesiastical discipline and religious controversy to be dealt with here. It has been related in detail by Racine, the most distinguished pupil of the Port-Royalist educational seminary, in his Histoire de Port-Royal. The most remarkable incident in it was the miracle alleged to have been wrought upon the person of the niece of Pascal, and firmly believed in, not to mention others, by two such eminent men as Pascal and Racine. The object of this miracle, which was wrought by means of a thorn from the crown of our Saviour, was to demonstrate the innocence of the nuns of Port-Royal, who were accused by the Jesuits of contempt of the holy sacrament, an accusation the more grievous as these nuns were specially devoted to the worship of the holy sacrament. But this vindication was unavailing, the Jesuits were miracle proof, and they succeeded in gaining the ear of the king. In 1664 Port-Royal de Paris was occupied by the police. The nuns, with the exception of a few who acceded to the terms of the Jesuits, and henceforth became the declared enemies of their former associates, were imprisoned for some months and then sent to Port-Royal des Champs, which was put under military surveillance till 1669, the soldiers behaving with great license and rudeness. In 1669 the two houses were permanently separated by royal authority. Port-Royal des Champs retained eighty nuns and two-thirds of the joint property, Port-Royal de Paris ten nuns and one-third, and was placed perpetually under the nomination of the king. The nuns of Port-Royal des Champs still persisted in refusing to sign the Papal edict condemning the doctrines of Jansenius, and on 29th October, 1709, the convent was finally suppressed by order of Cardinal Noailles, in execution of a bull of Pope Clement II. The nuns were dispersed in different convents, and their property given to Port-Royal de Paris. This convent continued in existence till the revolution, when its house was converted into a prison, and subsequently (1814) became the Maternity Hospital.

PORTRUSH, a small seaport in the north of Ireland, in the county of Antrim, 5 miles north of Coleraine. It is much resorted to for sea-bathing; has a well-protected harbour, and an active intercourse with Londonderry, Liverpool, and Glasgow. Pop. (1881), 1196.

PORT SAID, a town of Egypt, on the Mediterranean, situated on one of those narrow belts of land which separate Lake Menzaleh from the Mediterranean, exactly at the terminus of the Suez Canal. It was begun simultaneously with the canal in 1859, being designed for its terminal port. The houses are built on the European type, with sloping roofs, some of them being wooden cottages, built of materials imported from France, others being of masonry. There is here an outer harbour formed by two piers which jut out into the sea, each terminated by a lighthouse having a coloured light. The one to the east is 2070 yards in length, that to the west 2730. At the outer end their distance apart is 760 yards, at the inner 1530. They are formed of blocks of concrete, each 12 cubic yards in size and 22 tons in weight, made on the spot, of sand combined with hydraulic lime. The piers inclose an area of about 500 acres, which is dredged sufficiently deep for the accommodation of vessels of moderate size. The central portion is deepest, and admits large ocean steamers, which thus sail into the inner harbour and from it into the canal. Near the entrance to the inner harbour there is a very lofty lighthouse, formed of concrete and iron, and having a powerful light. This harbour is provided with quays, wharves, and other accommodation necessary for a large traffic. Port Saïd is called after Saïd Pacha, viceroy of Egypt from 1854 to 1863. The population, which is very varied in nationality, is about 10,000.

PORTSEA, an island of Southamptonshire, England, extending from north to south about 5 miles, and from east to west about 3. The island belongs to the tertiary formation. It comprises the borough and seaport town of Portsmouth, the town of Portsea, and several villages. The land is flat, and the soil in general fertile. The coasts are defended by several detached forts and castles, the most important of which are Fort Cumberland, Southsea Castle, and Hillsea. It is connected with the mainland by a bridge at its north end. See PORTSMOUTH.

PORTSMOUTH, the principal station of the British navy, a seaport, municipal and parliamentary borough of England, in Hampshire, on the southwest extremity of the island of Portsea, and at the terminus of the London and South-Western and the London, Brighton, and South Coast Railways, 68 miles S.S.W. London; lat. (Royal Naval College) 50° 48′ N.; lon. 1° 6′ 15″ S. It consists of the two towns of Portsmouth proper and Portsea (formerly separated from each other by what was called the Mill-dam Creek), and of several suburbs. Both towns, united together so as to form a fortress, were surrounded by

moats, walls, and ramparts, and entered by four gates, one of them designed by Inigo Jones. These defences having been rendered useless by the modern system of fortification, the ramparts have been pulled down, the gates removed, the creek and moats filled up, making a very large vacant space, of which two fine recreation grounds for military and naval officers and men have been formed, together with wide roads lined with trees. The work has been executed chiefly by soldiers and convicts. The best street is the High Street, which divides the town into two nearly equal parts, and contains the principal shops, hotels, and places of business. In its older parts Portsea presents a less attractive appearance than Portsmouth, but it has improved very rapidly in recent times, and has several good terraces, and one well-built open space called St. George's Square. The suburbs consist of Landport and Kingston adjacent to Portsea on the north, and of Southsea, on the east side of the town of Portsmouth. The two first named districts are for the most part occupied by artisans connected with the dockyard. They contain, however, some handsome villas and rows of well-built houses. Southsea is one of the favourite English sea-side resorts. Its situation commands fine views of the anchorage at Spithead, and of the Isle of Wight. The common, which extends down to the beach, forms a fine public recreation ground, and on it troops from the neighbouring garrisons are often assembled for field-days and reviews. Southsea Castle with its adjacent earthworks, the batteries of the Gosport side, and the circular forts built out in the roadstead, command the entrance to Portsmouth Harbour. A short line of rail to Southsea in connection with the main lines of the London and South-western, and London, Brighton, and South Coast Railways is in course of construction.

The ancient parishes of Portsmouth and Portsea, with the districts of Southsea, Landport, and Kingston, and the hamlets of Milton, Copner, and Hilsea, are all situated in the "Island of Portsea," which is separated from the mainland by a narrow creek called Portsbridge Canal. The Island of Portsea is bounded on the E. by Langston Harbour, on the W. by Portsmouth Harbour, and on the S. by Spithead and the Harbour Channel.

Among the public buildings the most conspicuous are the parish church (St. Thomas à Becket's) built about 1170, the Roman Catholic Cathedral with schools adjacent; the Presbyterian Church; the Independent Chapel in King Street; and numerous other places of worship; the Government House; the town-hall and market buildings combined; the Grammar School, Athenæum, theatre, hospital, Sailors' Home, &c. The grounds, which are beautifully laid out as the People's Park, were presented to the corporation by the government in 1872. The royal dockyard, which has recently been extended by the addition of new docks and basins, covers an area of about 500 acres, and is believed to be the largest and most magnificent establishment of the kind in the world. It is inclosed by a wall 14 feet high, and entered by a lofty gateway. It includes vast store-houses, containing all the materials requisite for naval architecture; machine shops, with all modern appliances; and extensive slips and docks, in which the largest ships of the navy are built or repaired; ranges of handsome residences for the port-admiral and other officials, and a Royal Naval College, with accommodation for seventy students, to whom a complete naval education is given. Outside the dockyard an area of 14 acres contains the gun-wharf, where vast numbers of guns and other ordnance stores are kept; and there is an armoury with 25,000 stand of small arms.

Portsmouth has no manufactures of any consequence, except those immediately connected with its naval establishments, and a few large breweries. Its trade, both coasting and foreign, is of considerable extent; the former consisting chiefly of coals from the Welsh and Newcastle coal-fields, cattle and sheep from the Isle of Wight and the west of England, and large quantities of corn and provisions from Ireland; and the latter of wine from different parts of the Continent, eggs from France, and timber from the Baltic. The number of vessels entered from foreign and colonial ports, with cargoes or in ballast, in 1882, was 428, tonnage 37,684; cleared 401, tonnage 46,576; in the coasting trade, entered 1729, tonnage 177,486; cleared 1788, tonnage 251,723. The total value of the exports abroad in 1879 was £9255; of imports from abroad £248,570.

Portsmouth is mentioned in the Saxon Chronicle as existing in 501. It appears to have taken the place of Porchester, which had been selected by the Romans for a naval station, but became unfit for that purpose in consequence of the receding of the sea. During the reign of Alfred a fleet of nine ships fitted at the port signally defeated the Danes, who had long infested the coast; and immediately before the Conquest a large fleet was fitted out here to intercept the Norman armament. About 1256 Henry III. assembled an army here for the invasion of France. In 1377 Portsmouth was attacked by the French, who succeeded in burning a part of the town. This disaster appears to have shown the necessity of fortifying the place, and the works, commenced by Edward IV., have been improved and extended during succeeding reigns. Of late years an extensive and systematic series of fortifications has been under construction for its complete defence. They extend along a curve of about 1½ mile at the north side of Portsea Island, commanding the Portsbridge Canal. A chain of hills, known as Portsdown, situated about 4 miles to the north of Portsmouth, and running almost straight west to east, thus commanding its front to the sea, are well fortified with strong forts. On the Gosport side the works are similar, with a line of forts extending for 4 miles. The usual garrison consists of only three regiments of foot. The *Royal George* sunk in Portsmouth harbour in 1782, drowning nearly 1000 persons. The municipal and parliamentary borough includes the whole of the Island of Portsea, except a small portion. It sends two members to the House of Commons. Pop. in 1881, 127,989.

PORTSMOUTH, a seaport town of the United States, in Rockingham county, New Hampshire, situated on a peninsula on the right bank of the Piscataqua, 3 miles above its mouth in the Atlantic, 50 miles north by east of Boston. Among the public edifices are the churches, an academy, an athenæum, with a library and good collections in natural history; an alms-house, two market-houses, and a state lunatic asylum. The chief industrial establishments are a machine-shop and car-factory, manufactures of hosiery and fine twist, and a large steam-factory for weaving the finer kinds of cotton fabrics. The harbour, the only one immediately connected with the sea which the state possesses, is one of the safest and most commodious in the United States. There is here a United States navy-yard. The town has long been noted for its skill in naval architecture and maritime enterprise. Pop. in 1880, 9690.

PORTSMOUTH, a seaport town and port of entry in the United States, Norfolk county, Virginia, at the mouth of the Elizabeth, 88 miles E.S.E. Richmond; with a court-house, jail, several churches, a bank, a theatre, a military academy, and a harbour allowing ships of the heaviest burden to come to the wharfs. At Gosport, a suburb of Portsmouth, are a United States navy-yard, dry dock, and naval hospital. Pop. (1880), 11,390.

PORTSMOUTH, a town in the United States, in Scioto county, Ohio, 82 miles south of Columbus, on the Ohio; with a court-house, jail, several churches, an academy, a bank, and extensive iron manufactures. Pop. (1880), 11,321.

PORTUGAL (ancient *Lusitania*), a kingdom in the south-west of Europe, forming the west part of the Iberian Peninsula; lat. 36° 55′ to 42° 7′ N.; lon. 6° 15′ to 9° 30′ W.; bounded east and north by Spain, and west and south by the Atlantic; greatest length, north to south, 345 miles; greatest breadth, 140 miles. It is divided into seven provinces, of which the names, area, and population are exhibited in the following table, along with the Portuguese colonial possessions in Africa and Asia:—

Provinces.	Area. sq. miles.	Population, 1881.
Minho,	2,807	1,014,768
Tras-os-Montes,	4,251	396,676
Beira,	9,244	1,377,432
Estremadura,	6,872	946,472
Alemtejo,	9,416	367,169
Algarve,	1,872	204,037
Total continent,	34,462	4,306,554
Azores,	921	269,401
Madeira,	315	132,223
	35,698	4,708,178

The provinces are divided into 21 districts, and these into 292 *concelhos*, of which 29 are in the islands, and 3960 *pegueziaa* (parishes), of which 172 are in the islands.

The colonial possessions of Portugal consist of—in Asia—Goa, Salsette, Bardez, Damaun, and Diu, all in Hindustan, Macao, and possessions in the Indian Archipelago, having together an area estimated at 7591 square miles, and a population estimated at 850,000: in Africa—Cape Verd, St. Thomas, and Prince's Islands, Senegambia, Guinea, Angola, Benguela, Sofala, and Mozambique, with an aggregate area of 696,956 square miles, and an estimated population of 2,484,030. The total area of the Portuguese possessions therefore amounts to 704,547 square miles, the population to 3,334,030. As a people the Portuguese are small in stature, and are generally inferior to the Spanish in physical appearance.

Coasts and Mountains.—Portugal is not separated from Spain, except on a small part of its frontier, by natural boundaries. Its shape is nearly that of a parallelogram. The coast-line, of great length in proportion to the extent of the whole surface, curves from the north in a S.S.W. direction, till it reaches Cabo da Roca, the most westerly point of the peninsula. Here it becomes somewhat irregular, forms two bays by the interjection of the remarkable promontory which terminates in Cape Espichel, and again curves round in a S.S.W. direction till it reaches Cape St. Vincent, where it suddenly turns east. This direction it retains to its termination at the mouth of the Guadiana. It is occasionally bold, and rises to a great height, particularly at Cabo da Roca, where it presents a range of giddy cliffs; but for the far greater part is low and marshy, and not unfrequently lined by sands and reefs, which make the navigation dangerous. It is not unprovided, however, with harbours. The number large and small is counted at twenty-one; but the only ones of importance, either from their excellence or the trade carried on at them, are those of Lisbon, Oporto, Setubal, Faro, Figueira, Aveiro, and Vianna. The interior is generally mountainous, a number of ranges stretching across the country, either in west, south-west, or south-south-west directions, forming a succession of independent river basins, while their ramifications, penetrating in all directions, form the water-sheds of numerous subsidiary streams, and inclose many wild and beautiful valleys. The loftiest range of all is the Serra d'Estrella, which may be considered as a continuation of the central chain which stretches across Spain between Old and New Castile, and between Leon and Estremadura. Near the town of Guarda it forms a fork, one limb of which proceeds north, and another south-east, while the main chain attains its culminating point of 7524 feet about 5 miles west of the town of Covilha, and is there continued in a S.S.W. direction to its termination in the lofty cliffs of Cabo da Roca. Nearly parallel to this chain, and at no great distance from it, are on the north the Serra de Alcoba, and on the south the Serra Moradal. In the north-west a branch of the Spanish Sierra Mamed, taking the name of Penagache, enters Portugal, and attains one of the loftiest heights of the kingdom in Mount Gavieira. At the opposite extremity the Serra Monchique, stretching across the country at a short distance behind the south shore, attains at its western extremity in Mount Foia the height of 4050 feet. The rugged nature of the surface makes the plains both few in number and of limited extent, but many valleys equally remarkable for beauty and fertility occur. The chief plains are those of Almeida and the Terra de Braganza, the former in the province of Beira, and the latter in that of Tras-os-Montes; the chief valleys, those of Chaves, Villarica, and Besteiros.

Geology.—The nucleus of the mountains is usually granite, overlain in the north by micaceous schist and other metamorphic rocks. In the south, particularly in the Serra Monchique, primitive limestone is very abundant. More recent limestones and schistous sandstones occupy large tracts in different parts of the country. Volcanic formations are very apparent in the Serra de Caldeirão, forming a continuation of that of Monchique. The mineralogical treasures seem more remarkable for their variety than for their value, though some are and many more, it is supposed, might be worked to advantage. They include argentiferous lead, iron, copper, cobalt, bismuth, antimony, fine marble, slate, salt, saltpetre, lithographic stones, mill-stones, and porcelain earth. Some gold also is washed from the sands of the Douro, Mondego, and other streams, and in several serras, particularly those of Estrella and Gerez; and many valuable pebbles and rock-crystals are found in a great number of places.

Rivers.—No rivers of importance take their rise in Portugal, and yet few countries in proportion to their extent are better supplied with large and navigable streams. The Minho in the north, forming the boundary between Spain and Portugal in the lower part of its course; the Douro, first skirting the east frontier, and then pursuing its course west to its mouth at Oporto; and the Tagus, all flow east to west; the Guadiana is the only large river of Portugal which deviates from the general west direction, and flows mainly south. In addition to these rivers for which Portugal is indebted to Spain, she claims as peculiarly her own the Vouga, Mondego, and Sado. Numerous small lakes are scattered over the surface and embosomed in the mountains.

Climate.—The climate is greatly modified by the proximity of the sea and the height of the mountains, the former tempering the excessive heat of summer by refreshing breezes, and the latter making the winter more rigorous than usual in countries under the same latitude. In general, however, winter is both short and mild, and in some places never completely interrupts the course of vegetation. In consequence of this many parts of Portugal enjoy the benefit of a double spring. Early in February vegetation is in full vigour; the plants shoot forth rapidly, attain maturity, and either wither away, or if of economical value are gathered and harvested. During

the month of July the heat is often extreme, and rain seldom falling the whole country, particularly at its lower levels and along the coast, assumes a very parched appearance. The drought generally continues throughout August and far into September; but at last the sky, which had previously been serene, becomes overcast, and copious showers descend. The second spring now begins, and the fields again become covered with flowers and verdure. Winter begins at the end of November. In the mountainous districts the loftier summits obtain a covering of snow, and retain it for a greater or less period according to their altitude; but in all the country south of the Douro, and at a moderate elevation, snow generally melts away within a month. Deluges of rain, however, continue to fall, and violent hurricanes and thunder-storms are not unfrequent. At this season, too, shocks of earthquakes are sometimes felt, particularly in the vicinity of the metropolis, where the disasters produced by it in 1755 were fearful almost beyond description.

Vegetation.—There are few countries with a more varied flora than Portugal. The number of species has been estimated to exceed 4000, and of these more than 3000 are phanerogamous. Many of the mountains are clothed with fine forests, chiefly of hardwood, among which the oak, both the ordinary species, or *Quercus robur*, and the cork-tree or *Quercus suber*, are conspicuous. In the central provinces at a moderate elevation magnificent chestnuts are very prevalent. In the south, in the province of Algarve, both the date and the American aloe are not uncommon. Fruits of excellent quality are common in every quarter, though it is only in the warmer and better-sheltered districts that the orange, lemon, and olive are cultivated with success on an extensive scale. The mulberry is admirably adapted to the climate, and by means of it a good deal of excellent silk is obtained; and a large extent of country is devoted to vine culture, caused partly by the demand for Portuguese wines in Britain. Agriculture, properly so called, is at a very low ebb, and Portugal fails in ordinary years to raise cereals in sufficient quantity to meet its own consumption. Among domestic animals the first place is due to the mule, of which very superior breeds have long been possessed, and are carefully preserved. Sheep, goats, and hogs are very numerous, but little attention is paid to their improvement. Horned cattle are few, and of a very inferior description. Game is not abundant, and the fisheries on the coast, though naturally productive, and at one time carried on to a great extent, have fallen off so much that the greater quantity of the fish used is obtained by importation.

Manufactures, Trade, Money, &c.—Manufactures are still of very limited amount, although they have been increasing of late years; but almost every family is so far manufacturing, that it supplies itself more or less with many of the articles of primary necessity. Among the articles made to some extent for sale may be mentioned armour at Lisbon, woollen cloth and other woollen stuffs at Portalegre, Covilhão, and Tundão; porcelain at Vista Alegre; delft and ordinary earthenware at Lisbon, Oporto, Coimbra, Beja, Estremoz, &c.; prints and lace at Lisbon and Oporto; cotton-twist at Thomar; silks at Braganza, Chacim, Oporto, &c.; copper and tin ware at Lisbon and other places; corks, ribbons, embroidery, hats, confectionary, fine soap, jewelry and cut gems, glass, paper, wicker-work, and tobacco. Ship-building also is well understood, and a large number of vessels are constructed at Lisbon, Figueira, Oporto, and Villa do Conde. Trade has received considerable stimulus from the formation of railways, of which about 1000 miles have been finished. The principal exports besides wine are cattle, cork, olive-oil, fruits, iron and copper pyrites, and wool; the principal imports are cereals, timber, salt provisions, colonial produce, woollen, cotton, linen, and silk tissues, iron, steel, and various other metals, coal, tar, and pitch, dyes, and drugs. In 1882 the total amount of the exports was £5,499,025, and the imports £8,068,202. The bulk of the trade is with Great Britain and Brazil, and the chief export to the former is wine. The value of the exports to Great Britain in 1882 was £3,676,054; imports of British home produce, £1,956,908. The value of the wine sent to Great Britain annually is over £1,000,000. Cotton goods to the value of nearly £1,000,000 are annually exported from Great Britain to Portugal, and a considerable amount in iron (wrought and unwrought) and woollen goods. The length of sea-coast, with the harbours found upon it, and the number of rivers, furnish great facilities for trade, but all the other means of internal communication are very defective. Accounts are kept in reis, milreis or 1000 reis, and conto de reis or 1,000,000 reis. The value of the rea is so minute that the milreis is worth only about 4*s.* 4½*d.* The French metric system of weights and measures was introduced into Portugal between 1860 and 1863. The Portuguese *libra* was 1·012 avoirdupois, the *arroba* was 32 libras, the *quintal* 4 arrobas. The chief linear measures were the *legoa*, or league of 18 to the degree; the *milha*, or common geographical mile; the *braça*, or fathom = 7·4 feet; the *vara*, or yard, one-half of the former; and *pe*, or foot = about 13 inches. For dry measure the *moyo* = 24 bushels; and for liquids the *almudo* = 4½ gallons, were used.

Government, Army, &c.—The Carta Constitutional of King Pedro IV., granted 29th April, 1826, and amended 5th July, 1852, is the fundamental law of the kingdom. The crown is hereditary both in the male and female line, but with preference of the male. The constitution recognizes four powers in the state—the legislative, executive, judicial, and moderating. The last, which is equivalent to prerogative, is vested in the sovereign. There are two chambers, the Camara dos Pares and the Camara dos Deputados. The two are called the Cortes Geraes. The peers are nominated by the sovereign, who also nominates the president and vice-president of the chamber. The peerage is hereditary in the direct line, but no peer can take his seat in the cortes unless he possesses an income of £500, and has taken an academical degree. An income of £22 clear qualifies an elector to vote for a member of the chamber of deputies. A deputy must have £89 per annum. A new parliament is convened without interval on the dissolution of the old. All laws relating to the army and taxation must originate in the chamber of deputies. Justice is administered by a great number of inferior judges, whose decisions are subject to revision in seventeen district courts. An appeal court, with extensive jurisdiction, sits at Oporto; and a supreme court, with jurisdiction over the whole kingdom, at Lisbon. The established religion is the Roman Catholic; all other religions are tolerated. It is governed by a patriarch at Lisbon, two archbishops at Braga and Evora, and fourteen bishops. Conventual establishments were repressed by decree of 28th May, 1834. Their revenues were applied to the redemption of the national debt. Their books were collected, and form a library of 30,000 volumes at Lisbon. There are only about 500 Protestants, mostly foreigners. Education is under a distinct ministry, and free from the supervision of the church. It is compulsory by law; but the law is not enforced, and the bulk of the children of the lower and middle classes do not attend school. The

University of Coimbra, the only one in the kingdom, has about 900 students; the secondary schools have about 9000, and the primary about 198,000 scholars. Very few females attend school.

The revenue for 1883–84 was estimated at £6,939,909, the expenditure at £7,911,247, showing a deficit of £971,338. The revenue has been constantly deficient for more than thirty years. The debt in 1881 was £96,000,000. A great portion of the debt is due to British creditors. The army consists of 30,000 men on the peace footing. It is raised both by conscription and enlistment. The navy numbers thirty-three steamers (one an iron-clad) with 129 guns, and sixteen sailing vessels.

History.—One of the smallest states of Europe, and almost fortuitously formed, Portugal has nevertheless a history of the most eventful kind, and one epoch shone with a glory rarely surpassed. The interest of the heroic age of Portuguese history does not turn upon destructive wars, but upon a long succession of brilliant geographical discoveries, planned with the best knowledge of the times, and pursued through a succession of generations with the tenacity and perseverance necessary to command success, while by means of these discoveries and others directly stimulated by them the whole world was opened up to European civilization, and a new epoch of history begun of which this small westernmost state of Europe was the pioneer. The Phœnicians, Carthaginians, and Greeks early traded to this part of the peninsula, which was afterwards conquered by the Romans. (See LUSITANIA and SPAIN.) The latter introduced among the inhabitants, who were a branch of the wide-spread Celts, their own civilization; the country was several centuries later inundated by the Germanic tribes (Goths, Suevi, Vandals—see these names) and in the eighth century (712) was conquered by the Saracens. (See MOORS.) When the gallant Spaniards of the Christian kingdoms of Castile and Leon (see SPAIN) finally wrested the country between the Minho and the Douro from Moorish hands, they placed counts or governors over this region. Henry the Younger of Burgundy, whose grandfather Robert I., duke of Burgundy, was grandson of the French king Hugh Capet, came into Spain about 1090, to seek his fortune in the wars against the Moors. Alphonso VI., king of Castile and Leon, gave him the hand of his daughter, and appointed him (1095) count and governor of the conquered districts, which comprised the provinces Entre Minho e Douro, Tras os Montes, and a part of Beira, and the harbours of Oporto (Portus Calle), from which Portugal is said to have derived its name. The count resided at Guimaraens, owed feudal services to the Castilian kings, but was permitted to hold in his own right whatever conquests he should make from the Moors beyond the Tagus (1112). Henry, and still more his son Alphonso I., were successful in their wars. The latter defeated Alphonso, king of Castile, in 1137, and made himself independent. Threatened by the Moors in 1139, he gained the brilliant victory of Ourique, and was saluted on the field King of Portugal.

With these events begins the history of Portugal. The cortes convened by Alphonso in 1143 at Lamego, from which they afterwards took their name, confirmed him in the royal title, and in 1181 gave to the kingdom, which was acknowledged by the pope, Alexander III., a code of laws and a constitution. The crown was made hereditary in the royal family according to the rules of primogeniture, but could pass to the collateral lines only with the consent of the estates. In the failure of male heirs the daughters were to inherit the crown. The independence of the kingdom was solemnly declared. The form of government, however, prepared by the Cortes of Lamego was by no means very definite, and the fundamental laws there promulgated were far from being kept inviolate. Alphonso himself made his kingdom tributary to the pope, but maintained his regal dignity against the Kings of Castile and Leon, with whom he was frequently at war. He extended his dominions to the borders of Algarve, and took Santarem in 1143. The capture of Lisbon (1147), which was effected by the aid of some English Crusaders and Hanseatics, who ascended the Tagus, was one of the most brilliant events of his warlike life. In 1162 he founded two military orders, the order of Avis (a village near Alemtejo) and the order of S. Miguel del Ala. Alphonso I. died 1185. He was succeeded by Sancho I., who began the conquest of Algarve; and he by Alphonso II. about 1212, who was excommunicated and had his kingdom put under interdict by Pope Honorius III. Sancho II., who succeeded him in 1223, was also excommunicated, and compelled to leave the kingdom in 1245. He died at Toledo in 1248, and was succeeded by his brother Alphonso III., who completed the conquest of Algarve (1251). He was excommunicated, and Portugal was again laid under interdict by Pope Innocent IV. in 1257. The immediate cause of his excommunication was the repudiation of his wife and his marriage to another. He died in 1279. Dionysius (1279–1325) opposed the encroachments of the clergy, who here as elsewhere accumulated the property of the country in their hands, and claimed exemption from taxation; yet he contrived to remain at peace with the pope. By turning to account the favourable position of the country for commerce he laid the foundation of the future greatness of Portugal. He equally encouraged agriculture, manufactures, navigation, and commerce. He admitted the representatives of towns to the Cortes. He liberally patronized learning, and founded a university at Lisbon, which in 1308 he transferred to Coimbra. By these and other acts of a wise and beneficent administration he earned the title of *father of his country*. Among his other epithets the most frequently applied is the *Farmer*. His reign was disturbed by war with Castile from 1295 to 1297, and at different periods by civil feuds in his own family. The order of Christ, which he instituted, obtained the estates of the Templars on the abolition of that order in 1319. He was succeeded by Alphonso IV. In conjunction with Alphonso II. of Castile he defeated the Moors at Salado in 1340. He murdered Inez de Castro, the wife of his son Pedro, in 1355. (See INEZ DE CASTRO.) He was succeeded by his son Pedro I., who exhumed the body of Inez, and caused her to be crowned along with him (1361). He died in 1367, and was succeeded by Ferdinand, on whose death in 1383 the male line of the Burgundian princes became extinct. His daughter Beatrice, wife of the King of Castile, should regularly have succeeded him; but the Portuguese were so averse to a connection with Castile that John I., natural son of Pedro, grand-master of the order of Avis, was saluted king by the estates. He maintained possession of the throne, having, with the assistance of his general, Alvaro Nunes Pereira, defeated the Castilians at Aljubarotta in 1385. With him begins the native line of Avis. After having concluded a peace with Castile in 1411 this excellent prince turned his attention to the improvement of the country. He ruled with a wise moderation a turbulent people and a haughty nobility, whose power had been increased by the concessions which he had been obliged to make to secure their concurrence in his accession to the throne. He transferred the royal residence from Coimbra to Lisbon. In 1415 he took Ceuta, the first of a series of enterprises which.

beginning with attempts at conquest on the African coast, resulted in those great expeditions of discovery on which the renown of Portugal rests. It was here that Henry the Navigator, his third son, began to form the plans of maritime discovery which led to such great results. In this reign were founded the first Portuguese colonies, Porto Santo (1418), Madeira (1420), the Azores (1433), and those on the Gold Coast of Guinea. John died of the plague in 1433. The reigns of his son Edward (till 1438) and his grandson Alphonso V. were less brilliant than that of John I.; but the latter was surpassed by that of John II. (1481–95), perhaps the ablest king that has occupied the throne of Portugal. In his reign began a violent struggle with the nobility, whose power had gained great accessions under his indulgent predecessors. The grants of crown lands made by them were revoked, and the judicial privileges of the nobility were restricted by the appointment of professional judges. The king caused the powerful Duke of Braganza, the chief of the turbulent nobles, to be beheaded, and put to death with his own hand in 1483 their next leader the Duke of Viseo. The expeditions of discovery were continued with ardour and with scientific method. The rich profits of the trade with Guinea supplied resources for new enterprises. The active spirit which was now more and more evidently developed among the Portuguese was quickened by the Jews, 83,000 of whom, driven from Castile, were received into Portugal on the payment of a capitation tax, and the most learned of this nation were then to be found in Portugal. In 1481 John sent two experienced men to attempt to reach by land the East Indies, the commercial wealth of which was the great object of his enterprises. Bartolomeo Diaz doubled the Cape of Good Hope in 1487, and Vasco de Gama reached India in 1498. In 1500 Cabral took possession of Brazil. For further details of Portuguese maritime enterprise see COLONY and INDIA—Portuguese India. These discoveries of Portugal are justly regarded as forming an epoch in European history, and are commonly held to be the starting-point of modern as distinguished from mediæval history. (See HISTORY.) Occupied with these great enterprises Portugal had neglected Columbus, whose discovery of America was made on behalf of Castile. Hence arose disputes between the navigators and colonizers of the two nations, which Pope Alexander VI. vainly attempted to settle in 1494 by his preposterous decree assigning to Portugal all countries to the east of a line of demarkation drawn 100 leagues west of the Azores and Cape Verd Islands, and to Spain all to the west of that line. While these great events were still in progress John II. was succeeded by his cousin Emanuel, who reigned from 1495 to 1521. The conquests of Albuquerque and Almeida made him master of numerous possessions in the islands and mainland of India, and in 1518 Lope de Soares opened a commerce with China. Emanuel ruled from Babelmandeb to the Straits of Malacca, and the power of Portugal had now reached its height. On this distant stage were performed great deeds of heroism, and this is the most glorious period of Portuguese history. But as in the case of Spain there is a dark side to the picture. The intolerant bigotry of superstition, which was then commonly mistaken for religious zeal, while it prompted to efforts for the conversion of the natives of India and America, too often inspired not merely the vulgar throng of adventurers who rushed to participate in the advantages of the new conquests, but likewise their chiefs and leaders, with a contempt for the infidels which combined with an insatiable avarice to produce deeds of cruelty equally revolting in their details and astounding in their magnitude. Lisbon became the most important commercial city of Europe; but the wealth which commerce accumulated was hardly sufficient to meet the expenses of the campaigns in Africa, where the arms of Emanuel were less successful. The King of Congo had indeed allowed himself to be baptized by the missionaries, without whom no discovery-ships then sailed; and sent his two sons to Portugal to be educated; and the colony on the Guinea coasts, from which all other nations were excluded by the Portuguese, was a source of great wealth, but the enterprises in Northern Africa were unsuccessful. The unfavourable character of the country prevented a rapid progress, and it is highly probable that Venice and Spain, jealous of the Portuguese prosperity, secretly afforded assistance to the Moorish princes. In the reign of John III., son of Emanuel (1521–57), the Indian discoveries and commerce were still further extended; but the rapid accumulation of wealth through the importation of the precious metals, and the monopoly of the commerce between Europe and India, proved disadvantageous to home industry. The Inquisition was introduced in 1536, to be employed against those Jews who had adopted the externals of Christianity. John II. had received into the kingdom a great number of those whom the intolerant rigour of Ferdinand and Isabella had driven from Spain, but they were still treated with so much severity that Emanuel had at first intended to extend to them greater indulgence. But in the first intoxication of his passion for his wife, the beautiful Eleonora, sister of Charles V., the old king was persuaded to proceed with such rigour against the Jews as to require them to embrace Christianity, under the penalty of being deprived of their children and made slaves. Whether they found means to prevent the execution of this cruel order, or whether Emanuel feared the effects of their despair, it is certain that he allowed them twenty years for their conversion. This measure led a great many of the Jews to conform publicly to the Christian usages, while they secretly adhered to their faith. The Inquisition practised the most revolting cruelties on their descendants. Still more injurious in its consequences than the Inquisition was the admission of the Jesuits into the kingdom by John III. (1540), who received them into his dominions earlier than any other European prince, as if he had been doomed to undermine the prosperity of his kingdom. The artful Jesuits gladly allowed themselves to be employed as preachers of the faith in India, where the Franciscans had hitherto been principally employed. The education of his grandson Sebastian, the heir-apparent to the throne, was likewise intrusted by John to the Jesuits, the worst tutors of princes. They inspired the young prince with that spirit of bigotry and that fanatical ambition which led to his death. He resolved to reduce the Moors in Africa (an attempt in which his powerful predecessors had always failed), and persevered in his projects with a wilful obstinacy in opposition to the remonstrances of his wiser counsellors. In 1578 he lost his life in the battle of Alcazarquivir, and left his throne to the disputes of rival candidates, of whom the most powerful, Philip II. of Spain, obtained possession of the kingdom by the victory of Alcantara, and Portugal had the misfortune to be annexed to a kingdom which from this time was hastening its own decline by a series of unsuccessful wars, and by its unwise administration. The Spanish yoke was grievous to the Portuguese, and a tradition rapidly spread among them that their king was not dead. As in the case of the Russian Dmitri (see DEMETRIUS), a succession of impostors (four in this case) appeared; but the power of Philip was too great to be shaken, and their

efforts proved abortive. Portugal continued under the dominion of Spain till 1640, and her vast colonial possessions were united to the already splendid acquisitions of her rival, which was now supreme both in India and America. The opportunity of founding an empire such as the world had never seen was lost through the infatuated bigotry of Philip II. The Dutch, whom in his miserable and short-sighted policy he shut out of Lisbon, had, owing to the indolence of the Portuguese, been hitherto the carriers between them and the rest of Europe, and they now determined to open up a direct trade for themselves, and attacked the Portuguese as well as the Spanish possessions both in India and America. After a fierce struggle they deprived the Portuguese of the Moluccas in 1607, of their settlements in Guinea in 1637, of Malacca in 1641, and of Ceylon in 1658. They also acquired about half of Brazil, which, after the re-establishment of Portuguese independence, they restored for a pecuniary compensation. To these losses was added the rapacity of the Spaniards, who alienated the finest domains of the Portuguese crown. The Portuguese nobility, exasperated by this oppression and the contemptuous conduct of Olivarez, minister of Philip IV., entered into a conspiracy which was planned and executed with great art, and, December 1, 1640, placed on the throne John IV., duke of Braganza, a descendant of the old royal family. All the remaining colonial possessions of Portugal returned to her allegiance with the exception of Ceuta, which Spain succeeded in retaining. John IV. was succeeded in 1656 by Alphonso VI., who ceded Tangier and Bombay to Charles II. of England as a dowry on his marriage with the Infanta. He was deposed by his brother Pedro II. in 1667, under whom (13th February, 1668) a treaty of peace was concluded with Spain, which acknowledged the independence of Portugal. A commercial treaty had been concluded with England under the first Braganza prince, and in 1703 a new treaty was concluded, called the Methven Treaty, from the name of the English ambassador by whom it was concluded, which secured to England the advantages of the newly-discovered gold-mines in Brazil. From this time the relations with England continued to become more intimate, as Portugal was no longer in a condition to maintain an independent attitude in European politics. Pedro ceased to summon the Cortes after 1697. During the long reign of John V. (1706–50) some vigour was exerted in regard to the foreign relations, and something was attempted for the promotion of the national welfare at home (the restrictions on the power of the Inquisition, and the foundation of an academy of Portuguese history, for example), but in the former case without decisive consequences, and in the latter without a completion of the plans proposed; while the sumptuous monastery at Mafra, and the dear-bought permission to institute a patriarch of Lisbon, exhausted the resources of the country. Under his son and successor Joseph I. (1750–77) the Marquis of Pombal (see POMBAL), a vigorous reformer such as Portugal required, administered the government. He attacked the Jesuits and the nobility, who during the preceding reigns had exercised a secret influence in the government. The exposure of the power of the Jesuits in Paraguay, their conduct at the time of the earthquake in Lisbon in 1755, and the conspiracy against the life of the king (1759), led to the suppression of the order. In 1757 they had been deprived of the post of confessors to the royal family, and forbidden the court. Two years after all the Jesuits were banished the kingdom, and their estates were confiscated. The Count of Schaumburg Lippe, to whose services against Spain (1760) Portugal was so much indebted, likewise reformed the Portuguese army; but soon after his departure the effects of his improvements disappeared. On the accession of Maria Francisca Isabella, eldest daughter of Joseph, in 1777, Pombal lost the influence which he had possessed for twenty-five years. To him Portugal owed her revival from her previous lethargy; and although many of his useful regulations did not survive his fall, yet the enlightened views which he introduced, and the national feeling which he awakened, were not without permanent effects. During the reign of Maria the power was in the hands of an ignorant nobility and a not less ignorant clergy. In 1792, on account of the sickness of the queen, Juan (John) Maria José, prince of Brazil (the title of the prince-royal until 1816), was declared regent (see JOHN VI.), and in 1799, her malady having terminated in a confirmed mental alienation, the prince was declared regent with full regal powers, but made no change in the policy of the government. His connections with England involved him in the wars of that power against France, and the Portuguese troops distinguished themselves by their valour in the Peninsular campaigns. But commercial distress, the accumulating debt, and the threatening language which Spain was compelled by France to adopt, led to a peace with France in 1797. The disasters of the French arms in 1799 encouraged the regent to renew hostilities in alliance with England and Russia; but after General Bonaparte had established his authority Spain was obliged to declare war against Portugal (1801), which, however, was terminated the same year by the Treaty of Badajoz, by which Portugal was obliged to cede Olivenza, with the payment of a large sum of money to Spain. Portugal meanwhile preserved a mere shadow of independence by the greatest sacrifices, until at last Junot entered the country, and the house of Braganza was declared by Napoleon to have forfeited the throne (on account of the refusal of the prince to seize the English merchandise in his dominions). The regent now threw himself entirely into the arms of the English, and November 29, 1807, embarked for Brazil. Junot entered the capital the next day, and Portugal was treated as a conquered country. An English force was landed, and in the northern provinces numerous bodies of native troops determined to sustain the struggle for freedom; a junta was also established in Oporto to conduct the government. After some hard fighting the decisive battle of Vimeira took place (August 21, 1808), which was followed by the Convention of Cintra and the evacuation of the country by the French forces. The Portuguese now took an active part in the war for Spanish independence. (See SPAIN.) On the death of Maria John VI. ascended the throne of Portugal and Brazil. This transference of the court of Lisbon into an American colony was followed by important consequences: firstly, that Brazil attempted to withdraw itself from dependence on England; and secondly, that the colony gradually became a separate state. In Portugal, on the contrary, the influence of England continued, and the condition of the kingdom was not essentially changed. The Peace of Paris (May 30, 1814) by no means, therefore, corresponded to the expectations of the nation, although it had exerted itself vigorously in the common cause, and Spain evaded the restitution of Olivenza, which had been provided for by the Congress of Vienna at the same time that Portugal was required to restore French Guiana to France. The court of Rio Janeiro therefore occupied the Banda Oriental, and Portugal was involved in new misunderstandings with Spain. In 1815 the Inquisition was abolished in the Portuguese dominions; the Jesuits were refused admission into

them; and the Jews, at the request of the pope (1817), were allowed the same privileges which they enjoyed in the Roman states. The absence of the court was viewed with dislike by the nation; the military were dissatisfied with the influence of Marshal Beresford, and the general feeling required some fundamental changes in the administration and constitution of government. A revolution in favour of constitutional government was effected without bloodshed (1820), and the king invited to return home. Before landing in Portugal he swore to observe the constitution which had been adopted. A counter-revolution of the nobles and clergy was vigorously repressed by the Cortes (February, 1823); but the queen, a Spanish infanta, who exercised great influence over her son Dom Miguel, gained the colonels of several regiments; a new reactionary movement was organized; and the Cortes, being overpowered, dissolved itself after a solemn protest on 2d June, 1823. In 1822 Brazil threw off the yoke of Portugal, and proclaimed Dom Pedro, son of John VI., emperor. Her independence was recognized in 1825. John VI. died 10th March, 1826, having named the Infanta Isabella Maria regent. She governed in the name of the Emperor of Brazil, Dom Pedro IV. of Portugal, who granted a constitution with two chambers, modelled on the French, 23d April, 1826. In May he abdicated in favour of his daughter Maria da Gloria. He imposed on her the condition of marrying her uncle Dom Miguel, who was intrusted with the government as regent; but the absolutist party in Portugal set up the claim of Dom Miguel to an unlimited sovereignty, and a revolution in his favour, notwithstanding the intervention of England, placed him on the throne in 1828. In 1831 Dom Pedro resigned the Brazilian crown, and returning to Europe, with the aid of English partisans, succeeded in overthrowing Dom Miguel, and restoring the crown to Maria in 1833. In 1836 a successful revolution took place in favour of the restoration of the constitution of 1820, and in 1842 another in favour of that of 1842. Maria died in 1853. Her husband Ferdinand of Saxe-Coburg, brother of Prince Albert of Britain, became regent for her son Pedro V. He placed the government on a purely constitutional basis, which was maintained by his son Pedro, who died in 1861, and by Louis I., who succeeded him, and who still reigns. The abolition of monopolies, the improvement of finances, the formation of railways, and the cadastral survey of the country, are among the measures which have distinguished his reign. Slavery was abolished in 1868; but according to the accounts of recent travellers the African colonies, otherwise neglected and ill administered, have disregarded this regulation. A conspiracy in favour of a federative republic with Spain was discovered and suppressed in 1872.

Portuguese Language and Literature.—The nature of the language of ancient Lusitania is not known. Words of Greek, Phœnician, Iberian, Celtic, and Carthaginian origin are found in Portuguese as in Spanish, indicating the relations into which commerce or conquest had brought the early inhabitants of the country. Apart from these local peculiarities the Portuguese is one of the Romance family of languages formed by the junction of the Latin-speaking Celts with the Teutonic races. The Moorish occupation has further infused into it a Semitic element. Under the early kings of Portugal all documents were written in Latin; judicial sentences were written in Latin till a comparatively recent time; it is still used in seals, coins, and monumental inscriptions. It was only under Alphonso III. and Dionysius (Diniz) that Portuguese began to be generally used in documents. The differences between Portuguese and Spanish are comparatively of modern origin, the two languages being very nearly alike in the time of Alphonso I. These differences are due partly to the different spheres of activity of the two peoples. The relations of Spain were with France, Italy, Austria, and the Low Countries; those of the Portuguese were almost exclusively with the Spaniards themselves, or with peoples removed from European civilization. The dialect of Spanish spoken in Portugal at the beginning of the monarchy, moreover, was the Galician, which was also that of the court of Leon; but that court subsequently adopted the Castilian, which became the dominant language of Spain. The decline of the Galician dialect in Spain and the formation of the Portuguese language through the influences peculiar to the people finally determined the separation of Spanish and Portuguese, and from cognate dialects made them distinct languages. Early French introduced by Henry of Burgundy and his suite also constituted an element in the formation of the Portuguese language, and old French words which have fallen into desuetude are still to be found in Portuguese. The French terms of heraldry were introduced as by the Normans into England, and the devices of the oldest Portuguese families are in French. In modern times, since the period of the French revolution, the Portuguese, notwithstanding their resistance to the aggressive designs of Napoleon and their close relations with England, have shown a strong tendency to imitate the French in everything, and the language has been considerably modified by the introduction of French expressions and grammatical forms.

The sixteenth century is the classical age of Portuguese literature, and the Royal Academy of Sciences has begun a dictionary in which all doubtful points in regard to the language are referred to quotations from the writers of that age. There is no determined orthography except that which the rules of printers have made prevalent in printed books. Royal edicts and other public documents were formerly cited as models of language, but in later times they were far from being distinguished by accuracy.

The Portuguese language has by means of colonization and emigration been pretty widely spread. It is spoken in Portugal, the Azores, Brazil, the Portuguese colonies in Asia, Africa, and America, and among the Portuguese Jews scattered over Europe, particularly in Hamburg and Amsterdam. The Portuguese possesses the richness and conciseness of the dialects founded on the Latin tongue. It appears to have derived from French the *j* sound and the nasal syllables, and it wants the strong aspirations and guttural sounds of the Spanish. It has less dignity than the Spanish, but is superior to it in flexibility. In popular songs it displays a delicacy and variety of expression which have made the Spaniards call it the language of flowers. It makes free use of augmentives and diminutives. It is soft and sonorous in sound, but the too frequent occurrence of the nasal *ão* somewhat mars its harmony. The words are systematically grouped, every substantive having in general an adjective, a verb, and an adverb corresponding to it. Latin terms are preserved in Portuguese which are found in no other language in Europe; but these, as well as its other Latin elements, are more radically changed than elsewhere, so that it is often extremely difficult to trace the derivation of Portuguese words. Medial consonants, such as *l* and *n*, are frequently suppressed, *doler* becomes *dor; populus, povo; ponere, pôr* (Italian *porre*). The dialects of Portuguese differ only slightly from each other. Those of Minho, Algarve, the Azores in Europe, and of Goa, Macao, Congo, Mozambique, and Brazil are furthest from the written. The *lingoa*

geral spoken on the eastern and western coasts of Africa, as well as in some parts of India and Ceylon, and which bears an analogy to the *lingua franca* of the Mediterranean, may be regarded as a dialect founded on Portuguese, and as containing reminiscences of the ancient maritime power of the people. Among works on the Portuguese language we may mention Grammatica da Lingua Portugueza por J. de Barros (4to, Lisbon, 1540), Origem da Lingua Portugueza por Dur. Nuñez de Leão (4to, Lisbon, 1606), Vestigios da Lingua Arabica em Portugal por Fr. João de Souza (small 4to, Lisbon, 1789), Diccionario da Lingua Portugueza por Moraes e Silva (two vols. small folio, Lisbon, 1831), Diccionario da Lingua Portugueza de Eduardo de Faria quarto edição pro uso des Portuguezes e Brazilieros, refundida, correcta e augmentada por D. Jose-Maria d'Almeida e Aurajo Correa de Laceda (two parts, 4to, Lisbon, 1858–59), Grammatica Analytica de Lingua Portugueza por D. Nuñez de Leão (12mo, Paris, 1831), Pocket Dictionary of Portuguese and English (1854).

Literature.—The oldest monuments of Portuguese literature do not go back further than 1125, from which date the poetical compositions of Egaz Moniz Coelho and of Gonzales Hermiguez. These are written in the Galician dialect. This dialect closely resembled the Provençal, and the Provençal bards who were received at the court of the kings of Portugal just missed assimilating the Portuguese as well as other languages of Southern Europe to their own. The Provençal literature in fact for some time absorbed all the efforts directed towards the cultivation of the higher arts of writing, and in Portugal, as elsewhere, it retarded the development of the native literature. During the twelfth and thirteenth centuries the Portuguese native literature could boast of nothing more than a collection of popular songs (*chacras*), remarkable for freshness and vigour. The first Portuguese collection of poetry (*cancioneiro*) was made by King Dionysius. It consisted of a selection of the court lays composed about his time by the Portuguese, Provençal, and Galician bards. The manuscript of this collection, discovered in the Vatican by Ferd. Wolf, has been published in Paris and Lisbon (1847) under the title of Cancioneiro del Rey Dom Diniz. To Dom Pedro, count of Barcellos, son of Dionysius, is attributed a Cancioneiro do Real Collegio dos Nobres. His half-brothers, Alphonso IV. and Affonso Sanchez, were likewise poets. Some of the Portuguese poets of this time wrote in Castilian, and are reckoned among Spanish writers. Some poems on the death of his wife, one of which is in Castilian, are attributed to Pedro I., husband of Inez de Castro. There is also a prose chronicle of Pedro's reign by Fernão Lopez, from which are derived the chief particulars of his vengeance on the abettors of the murder. In the fifteenth century the court was still the centre and source of the national literature. The sons and grandsons of John I. were poets and patrons of the troubadours. Galician, Castilian, and Provençal were still cultivated as well as the native language. Garcia de Resende, a poet of some merit, who lived under Emanuel, has collected in a Cancioneiro (Lisbon, 1516) the principal poetical works of this age. Bernardim Ribeiro wrote pastoral poems and romances in imitation of the Italians and Spanish. Sà da Miranda, who succeeded him in the same line, marks the transition from the fifteenth to the sixteenth century and the separation of the Portuguese from the other Spanish dialects and from the language of the troubadours. This progress is also observable in the prose chronicles which record the current history of the day. The reign of King John, the discovery and conquest of Guinea, the career of Prince Henry, and the first voyage of Columbus are among the subjects dealt with by the chroniclers. Literature still continued to be patronized by the royal family. King Edward (Duarte) wrote a book of morals for the use of his sons, and two works, The Art of the Cavalier and The Loyal Councillor, which have been republished in France by J. J. Roquette. There is also a treatise on military art by Alphonso V. The sixteenth century is the classic era of Portuguese literature. Pastoral poetry, the epic, and the chivalric romance flourished in an especial manner. The chief names are Sà da Miranda, Antonio Fereira, Camoens, Diego Bernardes, Andrade, Caminha, and Alvares do Oriente. Their compositions are distinguished by elegance and variety, but, like other modern pastorals, exhibit rather a tedious affectation of rusticity than a life-like representation of rural life. Sà da Miranda has also written epistles, sonnets, hymns, and other compositions. In his hymns he has employed for the first time the hendecasyllabic verse, which has become the chief instrument of Portuguese poetry. The numerous hymns, odes, elegies, and sonnets of Camoens are equally distinguished for elegance, but are marred by numerous conceits according to the taste of the period. The principal epic and the greatest poem in the Portuguese literature, almost the only one which has acquired a European reputation, is Os Lusiadas (The Portuguese) of Camoens, which has placed its writer in the rank of the few great poets of the highest class whose genius is universally recognized by the whole world. (See CAMOENS.) After Camoens as an epic writer comes Cortereal, who has celebrated the siege of Diù and the shipwreck of Sepulveda. Like Camoens he shows himself a great painter of nature.

The Portuguese romance writers claim to be the originators of the character of Amadis, but the question remains undecided between them and the Spaniards. Vasco de Lobeiro, Francisco Moraes, and Bernardim Ribeiro are among the leading romance writers. Lopez de Castanheda has written a Libro de Caballeria. The drama also began to be cultivated in the sixteenth century. The first *autos* and rustic dialogues were probably composed for the festivities of Christmas; a few rude comedies also preceded the classic period. Sà da Miranda studied and imitated Plautus. Ferreira, who followed his example, composed the first regular tragedy, Inez de Castro, only a few years after Sofonisba was produced at Rome by Trissino. Camoens wrote several theatrical pieces, among which are Amphitryon and Seleucus. *Autos, farsas*, and *comedias magicas* were far more numerous than regular pieces.

The chronicles in the same age expanded into history. The events of their own day in which their country played so large a part afforded ample matter of inspiration for historians as well as poets. Barros, also a romance writer, is esteemed the Livy of Portugal. He wrote the History of the Conquest of India in a style at once elegant, pure, and energetic. The Commentaries of Alphonso d'Albuquerque, by a nephew of the conqueror; the Chronicle of King Manuel and of Prince John, by Damian de Goes, a Portuguese ambassador; the History of the Discovery and Conquest of the Indies, by Lopès de Castanheda; the Chronicle of King Sebastian, by Diego Bernardo Cruz, are all works of great merit. Narrations of voyages are fewer than might have been expected, but there are a few of great interest—A Letter to the King of Portugal on the Discovery of Brazil, by Vas de Caminha, companion of Cabral; the Voyages of Magellan, narrated by some of his comrades; and the Voyages of Pinto, who visited China, Tartary, Arabia, and other countries. This work is one of the classics of the sixteenth century.

The opening of the seventeenth century is distinguished by the crowd of imitative epics which naturally followed the success of the Lusiad. Quevedo de Castro, Mascurenhas, and Brandam are among the principal authors of these works, the most noticeable feature of which is the national patriotism they continue to display after the loss of the political independence of Portugal. This century is also distinguished by great historical compilations. It was the period of repose after an epoch of great activity, and the absorption of the Portuguese nationality in the more powerful monarchy of Spain naturally turned all eyes to the recent period of its glory. The Monarchia Lusitana (1597–1690), Bernardo Brito's Eulogy of the Kings of Portugal, Faria de Souza's Europa Portugueza (1667), Asia Portugueza (1666–75), Africa Portugueza (1680), America Portugueza (left in manuscript), the historical works of Nunez de Laïo, Manoel de Mello, and others belong to this epoch. Antonio Vieira, a Jesuit preacher, is one of the most vigorous prose writers of this century. The letters of Alcofarrada are also among its notable productions. But the most astonishing writer of all was the padre Macedo, who composed 2648 epic poems, besides 110 odes and numerous dissertations. He wrote chiefly in Latin, Spanish, and Italian.

The Portuguese drama was nearly extinguished during this century by the predominance of the Spanish, to which even Portuguese writers contributed. Cocho Rebello has collected a number of the minor indigenous productions of the art—A Musa Entretenida de Varios Entremeses (Coimbra, 1658).

In the eighteenth century the influence of the French writers of the age of Louis XIV. so completely dominated Portuguese literature that it became almost entirely imitative. Translations from and imitations of the French formed the staple of its products in every department, and the nation that gave birth to the Lusiad condescended to copy the Henriade and the Lutrin. Scholarship in this age made greater progress than literature. The academy called the Arcadia was founded in 1757 by Antonio Diniz da Cruze Silva, the Portuguese Boileau, and other promoters of the revival of learning. It became extinct in 1776, and was replaced in 1779 by the Royal Academy of Sciences of Lisbon. Towards the close of this century two writers appeared who have formed schools, Francisco Manoel do Nascimento (1734–1829), an elegant lyrist, and Barbosa du Bocage, who introduced an affected and hyperbolical style of writing, which has been called, from the signature Elmano, which he adopted, *Elmanism*.

In the nineteenth century the classic school has been represented by the followers of Manoel do Nascimento, Domingo Maximiano Torres, and Ribeiro do Santos. Agostinho de Macedo, a follower of Barbosa, has thought good to recast the Lusiad under the title of O Oriente. Among other modern poets possessing some claim to originality may be mentioned Roque, Carvalho Moreira, Mouzinho de Albuquerque, Feliciano de Castilho, Herculano de Corvalho, Almeida Garret, João de Lemos, Antonio de Serpa, and Palmeirim. Through the efforts of these and others Portuguese literature has again begun to assume an aspect of native vigour. The drama has also been revived by J. B. Gomez, Pimenta de Aguiar, Mendes Leal, and A. Herculano. The Novo Castro of the first is considered by the Portuguese as their best drama. Alexandre Herculano and Rebello da Silva are also writers of history and historic romance. Castello Branco is a novelist. Orators, among whom José Estevão and Coelho de Magalhães may be mentioned, are numerous. Science, law, and political economy are likewise well represented.

Art.—The principal architectural monuments which Portugal possesses are due to the Goths and Moors. There are also numerous architectural relics of the Roman dominion, such as the ruins of an amphitheatre at Lisbon, those of a Corinthian temple dedicated to Diana at Evora, and a round tower named after Sertorius. The cathedrals of Coimbra and Braga and the church of Cedofeita at Oporto are due to the Goths. The châteaux of Pombal, Feira, Alcobaça, &c., were palaces inhabited by the Saracen princes. There are no native works of any importance. Although the art has been well patronized Portuguese painters are few and have never formed a school. Native sculpture is represented by a statue of Joseph I., the only work worth mention in this department.

PORTUGUESE MAN-OF-WAR, the popular name of the *Physalia utriculus*, a Cœlenterate organism, somewhat allied to the Medusidæ (which see) or Jelly-fishes, and included in the order Physophoridæ, of the class Hydrozoa. The organism consists of a large spindle-shaped *pneumatophore* or 'float,' a bladder-like structure, containing within it a second sac, the pneumatocyst, and by means of which these forms float buoyantly on the surface of the sea. This float, which communicates by an aperture with the outer medium, may measure 8 or 9 inches in length, and consists essentially of a modification or dilatation of the attached extremity of the cœnosarc or common medium by which the various parts of the organism are bound together. On the lower surface of this float the polypites, or separate zoöids or individuals of which this compound form is composed, are situated; and long contractile tentacles and feelers or 'hydrocysts' are also found attached at this portion. The float possesses a wrinkled upper margin or crest. These organisms are abundantly supplied with thread-cells or *cnidæ*, stinging or urticating organs with which the tissues of all Cœlenterata are provided. (Pl. CLXIII.–CLXIV., fig. 2.)

The popular name of these organisms has been derived from the fancied resemblance of their form to sailing-ships. The entire structure is of glassy or fleshy consistency, and coloured white, with violet and purple hues. The Physaliæ mostly abound in warm and tropical seas, and vast fleets of these forms may be seen floating on the surface of the water. They are sometimes driven ashore on the British coasts, *P. pelagica* being the species most frequently found on our shores. The effects upon the human skin of the stinging powers of the thread-cells of Physalia have been described as being exceedingly severe and painful. The pain at first experienced is very severe, and its effects resemble those following smart blistering or even an acute inflammatory attack. Numbness of the affected part, an increased temperature, blistered surfaces, and other symptoms follow the sting of a vigorous Physalia.

PORTULACEÆ, or PURSLANES, a natural order of exogens, consisting of succulent shrubs or herbs, with alternate or opposite entire leaves, without stipules, axillary or terminal; unsymmetrical flowers, usually ephemeral and expanding only in bright sunshine; calyx of two coherent sepals; five petals, either distinct or cohering in a short tube; stamens hypogynous or irregularly inserted with the petals into the base of the calyx; several much-divided stigmas, and a dehiscent fruit with numerous seeds attached to a central placenta. The species are found in dry parched places, chiefly at the Cape of Good Hope and in South America. Only one species belongs to Europe. The distinguishing features of the plants are succulency, gay ephemeral flowers, insipidity, want of smell, and dull green foliage. *Portulaca oleracea*, or common purslane, has been known from

time immemorial, and used both as a pot-herb and in salad, on account of its cooling and antiscorbutic qualities. *Claytonia tuberosa*, a Siberian plant, has edible tubers.

PORTUMNUS, or PORTUNUS, among the Romans the god of harbours, the same as the *Melicerta* or *Palæmon* of the Greeks. He had a small temple on the Tiber, and the *Portumnalia* were yearly celebrated in his honour. He bore a key in his hand as an emblem of his office.

POSEIDŌN, the Greek god of the sea, identified by the Romans with the Italian deity Neptunus. He was a son of Kronos and Rhea, and hence a brother of Zeus, Hadēs, Hēra, Hestia, and Dēmētēr. He was regarded as inferior in power to Zeus, although in Homer he is spoken of as equal in dignity. His usual residence was in the depths of the sea near Ægæ, in Eubœa, where he had a palace, and kept his horses with brazen hoofs and golden manes. The attributes ascribed and most of the myths regarding him have reference to marine phenomena. Thus he is called the earth-holder or earth-encompasser (*gaiēochus*), as the sea surrounds the earth, and the earth-shaker (*enosichthōn*), as the earth is shaken by the waves of the sea beating on the shore. He is the ruler of all other marine deities and of all animals who live in the sea. He gathers clouds, and raises storms, and allays them. In several myths he is represented as contending with some land divinity for the possession of particular spots of land. Thus he contended with Athēna for Attica (see MINERVA), with Hēra for Argos, with Hēlios (the Sun) for Corinth, with Zeus for Ægina, with Dionysos for Naxos, &c. All these stories appear to have arisen from the observation of the tendency of the sea to encroach at various places on the land. The horse, and more particularly the war-horse, was sacred to Poseidōn, and one of the symbols of his power. The dedication of this animal to the sea god was probably due to the resemblance which the Greeks detected between the swift springing movement of the horse and the advance of a wave, or between the curve of a wave about to break and the arch of a spirited horse's neck. The horse is said to have been created by Poseidōn in the contest with Athēna above referred to. It was this god also who presented to Peleus, on the occasion of his marriage with Thetis, the immortal horses Balius and Xanthus, celebrated in the Iliad as the horses of Achilles. The other well-known symbol of his power is the trident, or three-pronged sceptre. During the Trojan war Poseidōn was the constant enemy of Troy. The cause of this enmity was the ingratitude shown him by Laomedon, the second king of Troy, and the builder of the walls of the city. It is said that having quarrelled with Zeus, he was compelled by the latter as a punishment to join with Apollo in helping Laomedon to build Troy walls, but that he first agreed with Laomedon that a certain reward should be given them when the work was done. As the stipulated reward was afterwards refused, Poseidōn sent a sea-monster to ravage the plains around Troy, and this monster was on the point of devouring Laomedon's daughter when it was slain by Hercules. But Poseidōn's anger was not satisfied with this punishment, and he ever after cherished a deep hatred against the Trojans. Hence in some of the engagements before the walls of Troy he is represented as appearing among the combatants on the side of the Greeks. In the Odyssey Poseidōn is described as thwarting the return of Ulysses to his home, for his having killed Polyphēmus, a son that had been born to the god by the nymph Thoosa. Poseidōn was married to Amphitritē, and by her was the father of Triton, Rhodē, and Benthesicymē; but he had numerous other offspring by other mothers, divine and human. By Dēmētēr, or Erinys, he was the father of the horse Arion, by Medusa of Pegasus, by Theophane of the ram with the golden fleece, and by other mothers of Antæus, Polyphemus, Pelias, and Neleus. The worship of Poseidōn was common throughout Greece and the Greek colonies, but especially prevailed, as is natural, in the maritime towns. The animals sacrificed to him were horses and bulls, sometimes also wild boars and rams. The Isthmian games, and the Panionia or festival of all the Ionians, celebrated near Mycale, were held in his honour. In works of art Poseidōn is represented with features resembling those of Zeus, but he has not the calm majesty of the supreme god, although he is more powerfully built. When represented standing he always bears the trident in his right hand and a dolphin in his left. A common representation of him is as drawn in his chariot over the surface of the sea by hippocamps (monsters like horses in front and fishes behind) or other fabulous animals; and not unfrequently he is accompanied by Amphitritē, Tritons, Nereids, dolphins, &c.

POSEN (Polish, *Poznan*), GRAND DUCHY OF, a province of Prussia, bounded north by West Prussia, east by Poland, south by Silesia, and west by Brandenburg; area, 11,178 square miles. The surface is generally very flat, and extensively occupied by lakes and marshes. A small portion of it belongs to the basin of the Vistula, which merely touches it on the north-east; all the rest belongs to the basin of the Oder, which receives its drainage through the Warta in the south and centre, and the Netze in the north. The soil is for the most part light and sandy, and considerable tracts are covered with heath; but the far greater part of it either is, or is capable of being, brought under the plough, and many parts of it are covered with a rich alluvium or vegetable mould, yielding all the ordinary species of grain, millet, flax, hemp, tobacco, and hops. The pastures are extensive, and feed numerous herds of cattle, horses, and swine; considerable attention is paid to the rearing of poultry, particularly geese, and also to the rearing of bees. The minerals, not of much consequence, include bog iron-ore, saltpetre, limestone, and building-stone. The manufactures consist chiefly of woollen stuffs, linen, and leather. The trade in these articles, and in horses and swine is considerable; other exports are corn, cattle, tallow, leather, honey, wax, goose-feathers, and hogs'-lard. The inhabitants include a considerable mixture of Germans and Jews, but the great majority are Poles, Posen being one of the acquisitions which Prussia made by the dismemberment of Poland. It is divided into the two governments of Posen and Bromberg, Posen occupying the north half, and subdivided into sixteen circles (pop. 1,095,873); and Bromberg (pop. 607,524) occupying the south half, subdivided into nine circles. Total pop. (1880), 1,703,397. As part of Poland Posen was divided into the palatinates of Poznania, Gnesen, and Inowraclaw. At the first partition of Poland in 1772 the district of the Netze fell to Prussia, and the remainder in the second partition of 1793. Between 1807 and 1815 Posen formed part of the Grand-duchy of Warsaw, but in the latter year reverted to Prussia.

POSEN, a fortified town in Prussia, capital of the province and government of the same name, on the Warta and Lowna, 149 miles east by south of Berlin. It lies so low as to be exposed to inundations, particularly from the Warta, which flows through it. It is defended by a castle seated on a height, and three forts; is built with considerable regularity, but is more remarkable for the number than for the splendour of its public edifices. Of these the most deserving of notice are the cathedral and the Stanis-

ians church, both belonging to the Roman Catholics; the old Jesuit college, Episcopal palace, Roman Catholic seminary, two gymnasia (one Protestant and one Roman Catholic), normal and other schools, five monasteries, several hospitals and charitable institutions, a theatre, and some elegant mansions of the Polish nobility, many of whom reside here. The manufactures consist chiefly of machines, woollen and linen tissues, chintz, calico, ticking, sealing-wax, carriages, leather and leather articles, lacquerware, &c. There are also several breweries and distilleries. Posen is the see of an archbishop, the residence of a provincial governor, and the seat of important courts of primary and appellate jurisdiction, and numerous public offices. An important fair is held here on Midsummer's Day (the nativity of St. John). It was at one time a member of the Hanseatic League. Pop. (1880), 65,713.

POSES PLASTIQUES, or TABLEAUX VIVANTS, imitations of pictures in which living persons take the place of those depicted. A frame is made of sufficient width and height, and covered with gauze, behind which the persons stand in their proper attitudes, either invented by an artist for the occasion, or taken from celebrated historical pictures. Such exhibitions are sometimes produced on the stage.

POSIDONIUS, a Stoic philosopher, born at Apamea, in Syria, probably about 135 B.C. He studied at Athens under Panætius of Rhodes, after whose death in 112 he visited most of the countries bordering on the Mediterranean, and finally settled as a teacher at Rhodes, whence he is called the Rhodian. He taught the Stoic philosophy with great applause, was at the same time a statesman and one of the Prytanes, and went when fifty years of age as an ambassador to Rome. The most distinguished Romans were his scholars, and Cicero himself was initiated by him into the Stoic philosophy. Posidonius removed to Rome in 51 B.C., and appears to have died not long after. He wrote many works which are now lost. In his physical investigations he was more a follower of Aristotle than of the Stoic school, the members of which he greatly excelled in this region of knowledge. Bake collected the fragments of Posidonius's writings—Posidonii Reliquiæ, &c. (Leyden, 1810).

POSILIPPO. See PAUSILIPPO.

POSITIVE EYE-PIECE, the form of eye-piece generally used in microscopes and telescopes. It is well adapted for use with micrometers, its focus being outside the combination of lenses. It consists of two plano-convex lenses of equal focal length, the convex sides turned inwards, the distance asunder being two-thirds of the focal length of either. The focal length of the combination is three-fourths of the focal length of either.

POSITIVE PHILOSOPHY, or POSITIVISM, was the name made choice of by Auguste Comte to designate the system of philosophy which he began to publish in 1830, under the title of Cours de Philosophie Positive, in a series of volumes, which was completed in 1842. In 1846 it found its first English expounder and translator in Mr. G. H. Lewes, in the closing chapter of his Biographical History of Philosophy. Before that date it had been known in England only to a few men of science, and had rather been dipped into even by these few than thoroughly mastered. But in the case of Mr. Lewes himself it had gained a thorough convert. He had been an ardent student of metaphysics or ontology before he read Comte. 'Philosophy,' he tells us, in its old sense as distinguished from the sciences, 'had usurped too many of his nights and days, and had been the object and the solace of too great a portion of his bygone life to meet with disrespect from him' in writing its history, or 'that he should ever think slightingly of it.' 'But we respect it,' he added, to mark the complete intellectual revolution which Comte had wrought upon him, 'as a great power that *has been*, and no longer *is*. It was the impulse to all early speculation; it was the parent of positive science. It nourished the infant mind of humanity; gave it aliment and directed its faculties; rescued the nobler part of man from the dominion of brutish ignorance; stirred him with insatiable thirst for knowledge, to slake which he was content to undergo amazing toil. But its office has been fulfilled; it is no longer necessary to humanity, and should be set aside. The only interest it can have is a historical interest. . . . Philosophy is an impossible attempt. It never has had any certitude; never can have any.' It was the Philosophie Positive which had chiefly helped to bring Mr. Lewes to these new and somewhat startling conclusions, and it was natural that he should end his work with some account of the new philosophy which had given him the advanced stand-point from which he had surveyed the whole course of philosophical and scientific thought, from its earliest rise in Greece down to the present day.

However much we may dissent from Mr. Lewes's repudiation of all metaphysical doctrines, we can have no difficulty in accepting him as a highly qualified expounder of the positive philosophy which he has so enthusiastically embraced, making, of course, all necessary allowance for the fervent zeal of a convert. 'Comte,' he thinks, 'is the Bacon of the nineteenth century.' Like Bacon he fully sees the causes of the intellectual anarchy which prevails in the world of mind, and also sees the cure. 'In the present state of things the speculative domain is composed of two very different portions, namely, general philosophical ideas and positive sciences. The general ideas are powerless because they are not positive, that is, not certainly known to be true; the positive sciences are powerless because they are not general. The new philosophy, which, under the title of positive, M. Comte proposes to create, and the basis of which he has himself laid, is destined to put an end to this anarchy, by presenting a doctrine *positive*, because elaborated from the sciences, and yet possessing all the desired *generality* of metaphysical doctrines, without possessing their vagueness, instability, and inapplicability. This is a gigantic attempt for one individual; but it has been undertaken by one possessing the thews and sinews of a giant, and the result is astounding. We have no hesitation in recording our conviction that the Cours de Philosophie Positive is the greatest work of our century, and will form one of the mighty landmarks in the history of opinion.'

The fundamental principle of Comte's whole system, and that which most broadly distinguishes it from all others, is 'that important law of mental evolution which he has not only discovered, but applied historically. It forms the keystone of the arch.' This law of knowledge or of mind-action for which nothing less than universality is claimed, and which is alleged to exemplify and verify itself in the whole intellectual history of our race, is now familiarly referred to as the law of The Three Stages. It may be thus stated in the words of Mr. Lewes:—'Every branch of knowledge passes successively through three stages. 1st, the *supernatural* or fictitious; 2d, the *metaphysical* or abstract; 3d, the *positive* or scientific. The first is the necessary point of departure taken by human intelligence; the second is merely a stage of transition from the supernatural to the positive; and the third is the fixed and definite condition in which knowledge is alone capable of progressive develop-

ment. In the *supernatural* stage the mind seeks after *causes;* aspires to know the *essences* of things and their modes of operation. It regards all effects as the productions of supernatural agents, whose intervention is the *cause* of all the apparent anomalies and irregularities. Nature is animated by superhuman beings. Every unusual phenomenon is a sign of the pleasure or displeasure of some being adored and propitiated as a God. The lowest condition of this stage it that of the savage, namely, fetichism. The highest condition is when one being is substituted for many as the cause of all phenomena.'

'In the metaphysical stage, which is only a modification of the former, but which is important as a transitional stage, the supernatural agents give place to abstract forces (personified abstractions) supposed to inhere in the various substances, and capable themselves of engendering phenomena. The highest condition of this stage is when all these forces are brought under one general force named nature.

'In the positive stage the mind, convinced of the futility of all inquiry into causes and essences, applies itself to the observation and classification of laws which regulate effects; that is to say, the invariable relations of succession and similitude which all things bear to each other. The highest condition of this stage would be to be able to represent all phenomena as the various particulars of one general view.'

It is not to be understood, however, that because every branch of knowledge must pass through these three stages in obedience to the law of evolution, this progress is one strictly chronological. 'Some sciences are more rapid in their evolution than others; some individuals pass through these evolutions more quickly than others; so also nations. The present intellectual anarchy results from that difference, some sciences being in the positive, some in the supernatural, and some in the metaphysical stage; and this is further to be subdivided into individual differences, for in a science which on the whole may fairly be admitted as being positive there will be found some cultivators still in the metaphysical stage. The present condition of science exhibits three methods instead of one; hence the anarchy. To remedy the evil all differences must cease; one method must prevail. Auguste Comte was the first to point out the fact, and to suggest the cure, and it will render his name immortal.'

Another feature of Comte's philosophy which Mr. Lewes brings into prominence is his classification of the positive sciences, which Mr. Lewes eulogizes as both profound and luminous, and at the same time so simple and striking, that when once it has been stated the mind feels some difficulty in conceiving any other possible. The problem to be solved is the dependence of the sciences upon each other. This dependence can only result from that of the corresponding phenomena. The order of their dependence is determined by the degree of *simplicity* or *generality* of the phenomena. The principle, therefore, to be adopted is this, we must commence with the study of the most simple or general phenomena, and proceed successively to the most complex and particular. First of all, 'a distinction is to be made between the two classes of phenomena which are manifested by *inorganized bodies* and by *organized bodies.* The phenomena of the latter are obviously more complex than those of the former; they greatly depend upon inorganized bodies, while these in no way depend upon organized bodies. Organized bodies manifest all the phenomena of the inorganized, whether chemical or mechanical; but they also manifest the phenomena named *vital,* which are never manifested by inorganized bodies.' Carrying through this principle of division and distribution there emerges first the division of all physics into two grand departments of inorganic physics and organic. Then follows the division of inorganic physics into celestial and terrestrial physics; of terrestrial physics into mechanics and chemistry; and next the division of organic physics into physiology and sociology. 'The positive philosophy therefore resolves itself into five fundamental sciences, of which the succession is determined by a necessary and invariable subordination founded on a comparison of corresponding phenomena. The first (astronomy) considers the most general, simple, and abstract phenomena—those farthest removed from humanity; they influence all others, but are not influenced by them. The last (sociology) considers the most particular—complex, and concrete phenomena—those most directly interesting to man; they depend more or less upon all the preceding classes, without exercising on the latter the slightest influence. Between these two extremes the degrees of speciality and of complication of phenomena gradually increase, according to their successive dependence. Such,' adds Mr. Lewes, 'is Comte's classification reduced to its simplest terms, a remarkable evidence of the profound and luminous intellect which originated it. A striking proof both of the correctness of this classification and of the truth of his great law of mental evolution is seen in the fact, that the history of the sciences teaches us how they all developed themselves into the positive stage, precisely in their successive order of dependence. Astronomy was the *first* to become positive, sociology is the *last;* between these extremes have come terrestrial physics, chemistry, and biology in successive development.'

These grand generalizations of Comte have a strong fascination for the scientific mind by their immense sweep, and by reason of the vast mass of facts belonging to science itself or to its history, which they include within their scope and reduce into luminous order or classification. But this vastness of sweep and apparent all-dominancy of standpoint is the weakness as well as the strength of this new philosophy. When a strict criticism is applied to the system it discovers in it many weak and unsound parts, many statements of fact in the history of human knowledge which are only partially true, many omissions of facts, which, when brought into view, impose serious limitations and corrections upon assertions which are made in too absolute a form; and not only so, but many perversions of facts, both past and present, which, if considered and applied in their true meaning, would be found quite irreconcilable with the lines of demarcation which Comte lays down in his Three Stages of Human Knowledge and Thought. Is it not a fact, for example, that Newton continued to take a theological or supernatural view of the origin and the conservation of the physical universe after his discovery of the law of universal gravitation, just as much as he had done before his discovery? Is it not another fact of the same kind that Pascal's theological thought and convictions touching the system of the universe came after his mathematical and scientific activity and triumphs—not before them? And in our own time, long after astronomy and all the other branches of inorganic physics have confessedly arrived at the positive stage, is it not a significant fact that so many of our leading physicists are so careful to rebut the charge of dogmatic atheism, and that even the 'cosmic philosophy' itself, based though it is on the doctrine of evolution, has still a theism of its own to show, however much this may differ from what it calls 'anthropomorphic theism?' Or to use its own words, 'With respect to the affirmation of a supreme power upon which man is dependent, our cosmic philosophy is as much at one with Christianity as

Christianity is at one with older religious philosophies.'[1] What an emphatic rebuke is this last great fact to the overweening confidence and dogmatic arrogance of Comte's famous generalization of the Three Stages!—the supreme power recognized as distinctly by human science in its very last and ripest stage as in its very first and crudest! The philosophy of Herbert Spencer and John Fiske, both in the Old World and the New, still holding on to the theology of the first stage of science, although boasting of holding its place in the front line of progress among the foremost pioneers of inductive positive science!

But waiving farther strictures of our own, our remaining space will only allow us to trace a rapid outline of the criticism which the system has called forth from a number of eminent writers in this country and in America since the date of Mr. Lewes's first introduction of Comte's name to the English-speaking world. In 1853 Harriet Martineau published in two volumes a free and condensed translation of the Cours de Philosophie Positive, and in the same year Mr. Lewes gave to the world a much fuller and more precise Exposition of the Principles of Comte than he had had space to include in his Biographical History of Philosophy. In 1858 appeared the Catechism of Positive Religion, or a Summary Exposition of the Universal Religion, in Thirteen Systematic Conversations between a Woman and a Priest of Humanity; translated from Comte by Richard Congreve. These three publications greatly facilitated the study and understanding of the new philosophy and the new religion grafted upon it, and diffused a knowledge of their principles much more widely than before; and ere long the combined system called forth an ample reaction of theological, metaphysical, and scientific criticism.

Mr. Herbert Spencer led the way in 1864 in his pamphlet, The Classification of the Sciences, to which are added Reasons for Dissenting from the Philosophy of M. Comte. In 1865 Mr. John Stuart Mill followed with an elaborate and able critique of Auguste Comte and Positivism in the Westminster Review, which was afterwards published in a separate form, and which was of so much weight as coming from one of the chief thinkers of the age, that M. Littré, the foremost French disciple of Comte, found it necessary to publish a reply to it in the Revue des Deux Mondes of 1867, which also appeared in a separate pamphlet. These critiques of Spencer and Mill are all the more worthy of notice and study, that both these thinkers had come to be currently regarded as positivists of substantially the same school as Comte himself. But they had no wish, it now appeared, to be regarded in that light. With much in Comte's writings to admire and approve of, they also saw much to dislike and condemn. Much of what was true in them was not new, and a great deal of what was new in them was not true. 'Considered apart from the question of its truth,' Mr. Spencer observed, 'his system of positive philosophy is a vast achievement. But . . . there remains the inquiry, Has he succeeded? A thinker who reorganizes the scientific method and knowledge of his age, and whose reorganization is accepted by his successors, may rightly be said to have such successors for his disciples. But successors who accept the method and knowledge of his age *minus* his reorganization are certainly not his disciples. How then stands the case with M. Comte? There are some few who receive his doctrines with but little reservation; there are others who regard with approval certain of his leading doctrines, but not the rest: these we may distinguish as partial adherents. There are others who reject all his distinctive doctrines, and these must be classed as his antagonists. Declining his reorganization of scientific doctrine, they possess this scientific doctrine in its pre-existing state as the common heritage bequeathed by the past to the present, and their adhesion to this scientific doctrine in no sense implicates them with M. Comte. In this class stand the great body of men of science, and in this class I stand myself.' Mr. Mill's critique is equally discriminating. He draws a broad line of demarcation between Comte's earlier and later works, in the former of which he finds much to approve, in the latter very little—so little that he regards many of the speculations which they contain as quite unworthy of the genius displayed in the earlier writings. He would fain cover them with a veil, they are so absurd and ridiculous. Singularly enough, however, Mr. Mill has a good deal to say in favour or at least in apology of what must seem to most men the most absurd and ridiculous of all Comte's creations, his new religion—what he calls the religion of humanity, the *cultus* of collective humanity spoken of as the *Grand Être*. And these passages of the critique have a double significance now, when laid side by side with some other passages contained in his three posthumous Essays on Religion, from which it would almost appear as if Mill had become a disciple of this new religion himself, or at least had become inclined to prognosticate that the worship of humanity might one day supersede in the world the worship of Christ and of God.

Other criticisms have followed on both sides of the Atlantic down to the present date. In his Lay Sermons (p. 164) Professor Huxley expresses himself very disparagingly of that portion of the Cours, &c., of which he is best able to judge. 'I found the veins of ore few and far between, and the rock so apt to run to mud, that one incurred the risk of being intellectually smothered in the working. . . . That part of Comte's writings which deals with the philosophy of physical science appeared to me to possess singularly little value, and to show that he had but the most superficial and merely second-hand knowledge of most branches of what is usually understood by science. I do not mean by this merely that Comte was behind our present knowledge, or that he was unacquainted with the details of the science of his own day. No one could justly make such defects cause of complaint in a philosophical writer of the past generation. What struck me was his want of apprehension of the great features of science, his strange mistakes as to the merits of his scientific contemporaries, and his ludicrously erroneous notions about the part which some of the scientific doctrines current in his time were destined to play in the future.'

In his Lectures on Christianity and Positivism (1871), Dr. M'Cosh of Princeton College has before him all these strictures of Spencer, Mill, and Huxley when he remarks that 'the world will soon be in a position fairly to estimate M. Comte, who has often been underestimated and as often overestimated. At first little appreciated by the mass even of thinkers, he secured at an early stage the admiration of a select few, who discerned the vigour of his intellect, and saw the partial truth which his system contained, or who were subdued by his dogmatic spirit and power of assertion. These men spoke of him in exaggerated terms, and compared him to Bacon and to Leibnitz. His direct influence has all along been very small, being confined to those who had the courage to read through his ponderous volumes. But his indirect influence, through eminent men who followed his method and caught his spirit, has been very great. However, the time of reaction against

[1] Outlines of Cosmic Philosophy, by John Fiske, formerly lecturer on philosophy at Harvard University (1874).

him and his exclusive pretensions seems to have come. These criticisms of Mill, Spencer, and Huxley show that his day is fast declining.' The latest critique of Comte's system which has appeared is the most elaborate and exhaustive of all. It is that supplied in Mr. Fiske's Outlines of Cosmic Philosophy, based on the Doctrine of Evolution, with Criticisms on the Positive Philosophy. This work, as its preface explains, 'is based upon lectures given at Harvard University in 1869 and 1871, which were designed to include only a criticism of the Positive Philosophy.' In its present much developed form its criticism of positivism has become subordinate to the exposition and systematic presentation of cosmism—which is a new name for Mr. Herbert Spencer's philosophy, 'based on the doctrine of evolution;' and as one of the objects of the work never lost sight of is to discriminate, carefully and exhaustively, between *cosmism* and *positivism*—which the popular mind is apt to confound with each other, as substantially if not formally identical—the author has been obliged to exhibit the differences between the specific positivism of Comte and the generic positivism which he holds in common with all the chief professors of physical science, in a more exhaustive and elaborate way than has ever been aimed at before, even by Mr. Spencer himself. 'Though the real work of demolishing the undue pretensions of positivism has already been well accomplished by Mr. Spencer, most of whose arguments are here reproduced, it seemed to me that much might still be done toward clearing up the dire confusion with which in the popular mind this subject is surrounded, and this I realized the more keenly as it was some time before I had succeeded in getting clear of the confusion myself. Accordingly, on every proper occasion the opinions characteristic of the positive philosophy are cited and criticized, and on every occasion they are proved to be utterly irreconcilable with the opinions characteristic of Mr. Spencer's philosophy, and adopted in this work. The extravagant claim of positivism to stand for the whole of attainable scientific philosophy is, I trust, finally disposed of, when it is shown that a system of philosophy has been constructed out of purely scientific materials, and by the employment of scientific methods which opposes a direct negative to every one of the theorems of which positivism is made up.'

Assuming the validity of the distinctions thus fully pointed out by Mr. Fiske, we must cease to confound the positivism of Comte with the phenomenalism of Spencer, Mill, Bain, and many other writers. In a work so recent as Dr. M'Cosh's, quoted above, these three names, and those of Grote, Lewes, Buckle, and Professor Huxley are all grouped with Comte's own as 'representatives of positivism;' and Mr. Fiske admits that there are really plausible reasons why the positive philosophy should currently be regarded as representative of that whole genus of contemporary thinking which repudiates the subjective method.' He refers also to the fact that Mr. Lewes, in the latest edition of his Biographical History, &c., still maintains that the agreement between Comte and Spencer is an agreement in fundamentals, while the differences between them are non-essential differences; and 'I am not incapable,' he adds, 'of understanding and sympathizing with this tendency, for during eleven years I espoused the same plausible error, and called myself a positivist (though I was never a follower of Comte) in the same breath in which I defended doctrines that are utterly incompatible with positivism in any legitimate sense of the word.'

Comte, however, has still disciples and admirers in Great Britain equally faithful with Mr. Lewes, though much less distinguished. The following are some of the latest publications proceeding from this very limited school:—An Outline of the Positive Religion of Humanity of A. Comte, by F. A. Barton (1867); A General View of Positivism, by A. C., translated by Dr. J. H. Bridges (1867); The Unity of Comte's Life and Doctrine, a Reply to J. S. Mill, by Dr. Bridges; System of Positive Polity, by Aug. Comte, translated by Dr. Bridges (1875), vol. i. containing the General View of Positivism and Introductory Principles.

If the number of Comte's philosophical disciples in England is small, the number of those who are professed devotees of his 'Religion of Humanity' we should imagine is still smaller. Still as long ago as 1859 and 1860 there was at least one tiny congregation professing the new humanitarian faith at South Fields, Wandsworth; for we have seen in the British Museum two sermons preached there by Richard Congreve, on the anniversary in each of those years of the birth of Aug. Comte. The titles of the sermons are, 'The New Religion in its Attitude towards the Old,' and 'The Propagation of the Religion of Humanity.' Allusion is made in these sermons to other congregations of the same faith and ritual in Paris, and Long Island, New York; but all the language used in reference to the condition of the new culte implies that it had as yet made extremely little way in a world too much addicted to go in the old paths. 'I read, rather than speak to you,' began Mr. Congreve, on Wednesday, 19th Moses 71 [19th January, 1859], 'as our small number makes speaking difficult. . . . I do not speak to you as a priest of humanity; my age is a bar to that. . . . Where there are disciples or members, there, however limited their number, is a church. We have a faith, the outlines of a ritual, and sufficient numbers.' The peculiar designation, we may add, of the 19th of January, 1859, used by Mr. Congreve, is taken from Comte's very curious Calendrier Positiviste, ou Système générale de Commémoration publique du Culte systématique de l'Humanité (Paris, 1849)—

> 'L'amour pour principe—l'ordre pour base,
> Et le progrès pour but.'

This strange calendar of the new religion of humanity has thirteen months in each year, instead of the old-fashioned number, and it finds a place for all the celebrities of history, of every age and country, who, in Comte's universalistic judgment, have any claim in any way to have been the benefactors of humanity.

POSSE COMITATUS, in law, the power of the county or the citizens who are summoned to assist an officer in suppressing a riot or executing any legal process: the word *comitatus* is often omitted, and *posse* alone used in the same sense.

POSSESSED. See DEMONIAC.

POST-CAPTAIN. See CAPTAIN.

POSTE-RESTANTE. A letter so addressed is not intended to be delivered at the residence of the person to whom it is addressed; but to be left at the office till called for by the proper person, who is expected to give some proof of his identity, either in the form of a passport, or in some other way. At the poste restante in London, a person calling for a letter is not only required to give such proof, but also to state from what places he expects letters. This mode of addressing letters is frequently resorted to in the case of tourists and others having no fixed place of residence. Letters so addressed to one town on the Continent, if not called for there within a certain time are sent in rotation to several of the other towns frequented by tourists, and if not called for at any of them are returned to the writer. In this country letters addressed *poste restante* are kept one month, and then returned. In the provincial

towns of the United Kingdom no one having a fixed residence is allowed to have his letters addressed *poste restante* to the post-town to which his residence belongs, and when such letters are received the officials are instructed to deliver them.

POSTERN, more frequently called a *sally port*, is a small gate generally made in the angle of the flank of a bastion, or in that of the curtain, or near the orillon, descending into the ditch, by which the garrison may march in and out unperceived by the enemy, to relieve the works, make sallies, &c.

POSTING, travelling by means of horses hired at different stations on the line of journey. Such a system appears to have been established by private enterprise on some of the main routes in England, at least as early as the reign of Edward II. It was afterwards made a government monopoly. As letters were originally forwarded in the same manner, the name of post-office has come to be applied to the institution charging itself with the conveyance and delivering of letters.

POST MORTEM ('after death'), a Latin term used as in the phrase *post mortem* examination, an inspection made of a dead body by medical men in order to ascertain the cause of death.

POST-NUPTIAL CONTRACTS, in Scotch law, are contracts entered into after marriage between the husband and wife, usually with the view of providing for the wife and children. The general rule by which such contracts must be construed, is that after marriage the wife and children can take nothing in competition with the creditors of the husband. Yet such a contract will be held to be valid even against them, provided that it was made while the husband was solvent, and the sum allotted to the wife or children by way of provision is not excessive in amount; and even when it was made after the contraction of debt by the husband, it will be considered valid to the extent of a moderate aliment for the wife, but not for the children. In English law, a contract of this nature is called a post-nuptial settlement, and is valid unless set aside by the statutes against fraudulent conveyances 13 Eliz. cap. v., made perpetual by 29 Eliz. cap. v., and 27 Eliz. cap. iv. s. 2, made perpetual by 39 Eliz. cap. xviii., which declare void any conveyance made with intent to defraud creditors or others of their actions, suits, debts, accounts, &c., or to defraud and deceive any person, bodies politic or corporate, who shall purchase the objects conveyed.

POST-OBIT BOND, a mode of contracting loans, often resorted to by heirs and others who expect a succession to open to them on the death of some third party. The condition in the bond is, that the sum borrowed shall not be exigible till that party's death; and hence, not only in consequence of the uncertainty of the event, but also sometimes in consequence of the uncertainty of the succession itself, which may be contingent, and perhaps never be realized, the creditor usually makes very exorbitant terms. Many cases have figured in the courts of law in which the sum advanced was not a tenth of that stipulated to be repaid.

POST-OFFICE, one of the most effective instruments of civilization, to be ranked with the art of printing and the mariner's compass. The name of *post* is said to be derived from the Latin *positus*, (placed), because horses were put at certain distances to transport letters or travellers. We find the first recorded postal system in the Persian Empire. According to Xenophon Cyrus the Elder caused couriers, with saddled horses, to stand ready at different stations throughout the empire, situated one day's journey from each other, in order to receive reports from the provinces without delay. In the time of Julius Cæsar the service of couriers in the parts of the Roman dominions under his government was so well organized that of two letters which he wrote from Britain to Cicero at Rome, the one reached its destination in twenty-six, and the other in twenty-eight days. Such services, however, were only established by governments or persons in authority for their own use. Private persons, in their intercourse with one another, had to employ slaves to convey their letters to their destination, or to trust to the chance of finding some person who was going to the place to which the letter was addressed, and was willing to undertake the delivery of it. Hence we meet with frequent complaints in the letters which have come down to us from ancient times, of the long delays in transmission. The emperor Diocletian, at the end of the third century, appears to have been the first to establish a postal system for the benefit of private persons, but we cannot tell how long this system remained in operation. At later dates Theodoric the Great, Charlemagne, and others who possessed for a shorter or longer time extensive dominions, had well-organized services for communication with all parts of their empire, but it is only at a comparatively late period that we find the beginning of the modern postal system intended for the use of the whole community.

The first traces of a postal system in England are observed in the statutes of Edward III.; yet the supposition is not well founded that from that time the post was established as a public institution. Edward IV. placed post-houses at intervals of 20 miles; and in the north a military post was established, to communicate as quickly as possible with the army during the Scottish war. This institution was, indeed, authorized by the reigning king; but it was probably owing to the king's brother Richard, who commanded the army. At what time and under what conditions the public were able to avail themselves of it we have no certain knowledge. That this post, nevertheless, was for a long time very limited, and but partially used, is obvious from the fact that, not long before the reign of Charles I., merchants, tradesmen, and professional men in the whole kingdom resorted to less secure means of conveyance, or employed express messengers, at great expense, to carry their correspondence. The universities and principal cities had their own posts—messengers who performed long journeys, riding or walking, and returned with the answers to the letters. In this manner the post was conducted in Scotland till a much later period. In 1543 a post existed by which letters were carried from London to Edinburgh within four days; but this rate of transportation, extraordinarily rapid for that period, lasted but a short time. After Camden, who was much employed by Elizabeth in her Scottish affairs, Thomas Randolph (in 1581) held the place of postmaster-general of England. James I. set on foot, under the superintendence of Matthew de Quester, a system for forwarding letters intended for foreign lands. Hitherto this had been done by private persons. The foreign merchants settled in London preserved long after the privileges belonging to the place of postmaster for foreign letters. In 1632 Charles I., by a proclamation, forbade letters to be sent out of the kingdom except through the post-office. In 1635 he established a system of posts for England and Scotland, which was conducted according to new and judicious regulations. All private and local posts were abolished, and the income of the post-offices was claimed by the king. This institution was under the direction of Thomas Witherings, who was removed in 1640, on account of notorious abuses. To him succeeded Philip Burlamachy, who

was under the immediate control of the secretary of state. These arrangements suffered during the civil wars many important interruptions, or were almost entirely annihilated. Yet no sooner was public tranquillity restored than a commission was appointed, and a postal system arranged, under the direction of the attorney-general, Edmund Prideaux, which became so profitable that the posts could now be leased for £10,000, while before the support of them had cost £7000. The lessee still made so large profits that the common council of London looked upon him with jealous eyes. In 1683 a penny post was set up in the metropolis. During the government of William III. acts of Parliament were passed which regulated the internal postal system of Scotland; and, by the ninth act of Queen Anne, the postal system of England was arranged on an improved footing, on which, with various modifications from time to time, indeed, it continued till the radical change of our own day, for which we are mainly indebted to the admirable sagacity and persevering labours of Mr. (afterwards Sir) Rowland Hill. That gentleman gave the first intimation of his plan in a pamphlet in the year 1837. The reasonings therein laid down, and the facts and figures adduced, were all convincing to the thinking portion of the British public. He plainly showed, on general principle, that our post-office system was at once costly and inefficient; that it had fallen, partly from the abuse of franking privileges (see FRANKING LETTERS) and partly from impolitic charges on payable letters, into a state of decrepitude; that the outlay, for the convenience it gave to the individual subject, was enormously great, while the returns to the state were disproportionately small. The average cost of each letter, for all distances in Britain, Mr. Hill showed, was then about 6¾*d.* The post-office charges at that time were regulated by the following tariff:—For a single sheet letter sent 15 miles and under, 4*d.*; 15 to 20, 5*d.*; 20 to 30, 6*d.*; 30 to 50, 7*d.*; 50 to 80, 8*d.*; 80 to 120, 9*d.*; 120 to 170, 10*d.*; 170 to 230, 11*d.*; 230 to 300, 1*s.*; 300 to 400, 1*s.* 1*d.* For every 100 miles beyond, or portions thereof, 1*d.* more.[1] The results of these charges Mr. Hill thus summed up:—'From 1815 to 1820 the annual gross revenue of the post-office department was £2,190,597; from 1832 to 1837 it amounted to £2,251,424. The positive increase in seventeen years was £60,827, averaging only £3578 yearly, or little more than one and one-half per thousand; although in these seventeen years the increase of population had been 25 per cent., or 250 per thousand, and the advance in trade, industry, intelligence—in short, of every species of material and intellectual activity—was still greater.'

Mr. Hill soon had the happiness to get the legislature to adopt his magnificent plan, in its principal features at least—that of a uniform penny postage for all inland borne letters and packets not exceeding a certain weight, commencing at ½ oz. By 2 and 3 Victoria, cap. lii., passed August 17, 1839, the great principle was adopted, and the Lords of the Treasury were empowered to take the necessary steps. Accordingly, on the 12th November following, their lordships issued a minute reducing the postage of all inland borne letters, &c., to 4*d.* as a preliminary step. On the 10th January, 1840, the uniform rate of 1*d.* per ½ oz. for prepaid letters came into operation.

[1] The smallest sheet, if cut in two, was charged double postage. The inclosure of a note or a bill, or even one's address, if separate—in short, anything, however small—made the letter containing it double. Much keen investigation of suspected letters took place in a room set apart for that business. The searchers worked by gas-light, that of day being excluded.

While the cost of letter correspondence has been thus reduced, the rapidity of its transmission has been likewise much quickened. Palmer's mail-coach system, the great boast of the latter portion of the past century, still kept Edinburgh and Glasgow at three days' distance from London; they are now, thanks to the powers of steam, reached in less than a sixth part of that time. Both these circumstances, together with the great development of commerce which has taken place in recent years, have had, as might have been expected, the effect of tremendously increasing the work done by the post-office department in this country. In 1839 the total number of letters conveyed through the post-office was estimated at about 76,000,000; in 1842 the number had increased to 208,000,000. In 1883 it had reached 1,281,000,000. The revenue, of course, fell for a period; but in 1843 it had already reached £1,578,145, while the highest revenue that had previously been obtained from the department was only £2,400,000, which was the revenue for 1839. The net revenue in that year was £1,659,509. In 1852 the gross revenue on the new system overtook that which was yielded on the old, and it is still going on increasing. The net revenue exceeded the highest that had been obtained on the old system for the first time in 1856, when it was £1,660,229. In 1882–83 the postal receipts amounted to £7,740,000, the expenditure to £4,463,000, thus leaving a surplus revenue of £3,277,000. The receipts on account of the telegraphs amounted to £1,750,000 while the expenditure was £1,718,000, the surplus revenue being thus £32,000.

Since the great postal reform of Sir Rowland Hill many important improvements have been made with regard to the management of the post-office business. The first of these improvements was the introduction of postage-stamps on the 6th of May, 1840. Before this prepaid letters were distinguished by a red mark, which continued to be used for some little time after the introduction of postage-stamps, until this mode of paying the carriage of letters in advance became universal. Another great improvement was the adoption of postal carriages on railways, by which the delivery of letters was greatly accelerated. These carriages are fitted up with a net-work on the outside, which may be let down on approaching stations in such a manner as to receive letter-bags which are dropped into it while the train is travelling at full speed. In the inside they are fitted up with pigeon-holes marked with the names of different towns, and the sorting of the letters may thus proceed during the transit. Sometimes bags are made up for stations on the line, and are thrown out as the train passes.

The rates of postage established on the 10th of February, 1840, continued in operation till the 5th of October, 1871, when the present rate was introduced, namely, for every letter not exceeding 1 oz. 1*d.*; above 1 oz., but not above 2 oz., 1½*d.*; and ½*d.* additional for every 2 oz. or fraction of 2 oz. up to 12 oz. When a letter exceeds 12 oz. in weight, it is charged at the rate of one penny per oz. on the whole weight. Letters not prepaid or insufficiently prepaid, are charged double postage or double the deficiency on delivery. Redirected letters are charged additional postage at the prepaid rate; but letters addressed to officers, soldiers, or seamen on service abroad, and also in certain cases to those at home, are re-directed without any additional charge. No letter can be conveyed by post if it is more than 1 foot 6 inches in length, 9 inches in width, and 6 inches in depth, unless it proceeds from, or is sent to, one of the government offices. When special security is required for the delivery of a letter, the

letter may be registered for a fee of 2*d.* in addition to the postage, which enables it to be traced, as each person into whose hands it passes must give a receipt for it. In return the post-office undertakes, under certain conditions, to make good the value of the letter up to £2, when it or its contents are lost. An unregistered letter supposed to contain coin or some article of value may be charged eightpence on delivery. The post-office now also certifies the posting of a letter on payment of ½*d.* Any newspaper published at intervals not exceeding seven days, and registered at the General Post-office in London, may be sent by post to any part of the United Kingdom for one halfpenny, provided it is printed on a sheet or sheets of paper unstitched. The postage must be prepaid, and the paper must either be without any wrapper at all, or have one which is open at both ends, so that the paper may easily be removed for inspection. The paper must contain no writing either on the inside or the outside except the address. Packets of newspapers may be made up and sent at the rate of ½*d.* for every 2 oz. or fraction of the same up to 14 lbs., beyond which no packet can be conveyed. In size such packets must not exceed 2 feet in length, by 1 foot in width and depth. Book-post packets are sent at the same rate, but they must not exceed 5 lbs. in weight nor be more than 18 inches in length, 9 inches in breadth, by 6 inches in depth. The packets may contain books, paper, or parchment, with or without writing or printing upon them, provided there is nothing in the shape of a private letter; and maps, prints, &c., if not in glass frames; and if in a cover the cover must be open at both ends, leaving the packets and their contents open to inspection. Although book-packets must contain nothing of the nature of a private letter, circulars which are wholly or in great part printed or lithographed may be sent by book-post either singly or in packets, and in ordinary book-packets an entry is allowed on the first page of a book stating by whom it has been sent. If any other private communication is found in the packet it will be taken out and forwarded to the address written on the packet, double letter postage being charged for it; and if it is written in such a manner that it cannot be separated from the packet, the whole will be forwarded at the same rate. Since 1870 post-cards having a halfpenny stamp printed on them have been issued by the postal authorities, as a means of conveying any communication, whether written or printed, that the sender does not object to leave open to view. Since 1883 parcels may be sent by post between any places in the United Kingdom at the following prepaid rate:—not exceeding 1 lb. in weight, 3*d.*; between 1 lb. and 3 lbs., 6*d.*; between 3 lbs. and 5 lbs., 9*d.*; between 5 lbs. and 7 lbs., 1*s.* No parcel may exceed 3 feet 6 inches in length, or with length and girth combined, more than 6 feet. Postage stamps for 1*d.*, 2*d.*, 3*d.*, 6*d.*, 9*d.*, 1*s.*, 2*s.* 6*d.*, 5*s.* and over may be used for receipts and certain other purposes instead of Inland Revenue stamps, and also for the payment of inland telegrams. It is forbidden to forward any indecent book, card, engraving, or other article, or any letter, packet, paper, &c., having thereon any words, marks, &c., of an indecent, obscene, libellous or offensive character.

Other departments under the management of the post-office in Great Britain are the money-order department, the savings-bank department, annuities and life assurance department, and telegraph department. For the savings-bank department see BANKS, and for the annuities and life assurance department see POST-OFFICE INSURANCE. The money-order department was annexed to the post-office in 1838. The rates were then fixed at 6*d.* for all sums not exceeding £2, and 1*s.* 6*d.* for all sums exceeding £2 and not exceeding £5. In 1840 these rates were reduced to 3*d.* and 6*d.* respectively. The present rates are 2*d.* for sums under 10*s.*, 3*d.* for sums of 10*s.* and under £2, and an additional penny for every pound or fraction of a pound up to £10, which costs 1*s.* A new kind of money-orders have come into use in 1881, in the shape of transferable postal notes for fixed sums, forming a kind of small currency. The amounts of and charges on these notes are: 1*s.* and 1*s.* 6*d.*, charge ½*d.*; 2*s.* 6*d.*, 5*s.*, and 7*s.* 6*d.*, charge 1*d.*; 10*s.*, 12*s.* 6*d.*, 15*s.*, 17*s.* 6*d.*, and 20*s.*, charge 2*d.* The total value of money-orders issued in 1882–83 was £27,597,883. There are now money-order conventions with most foreign countries and with all the colonies.

The telegraph lines of the United Kingdom have been worked by the post-office since February, 1870. An act passed in 1868 authorized the master-post general to buy up all the lines already in existence, to make extensions and improvements as occasion required, and to work them as part of the post-office business. A second passed in 1869 gave the government a monopoly in telegraphing with certain reservations in favour of railways, newspapers, and persons possessing or renting private telegraphs. The total number of telegraph offices at the time when the business was taken over by the state was 2932; at the end of March, 1879, it was 5254. The total length of postal telegraph lines at the end of March, 1883, was 27,103 miles, and 132,459 miles of wires (including lines rented by private persons). The rate is 1*s.* for a message of twenty words (the address of sender and receiver not being counted), and 3*d.* additional for every five words, or every group not exceeding five words above that number.

By act 7 and 8 William IV., and 1 Victoria, cap. xxxiii., the postmaster-general has the exclusive privilege of transmitting letters with the following exceptions: letters sent and delivered by a private friend; letters sent by special messengers on the private affairs of the sender or receiver; writs, &c., issuing from the courts of justice; letters sent out of the kingdom by private vessels; communications from owners of vessels or of their cargoes sent gratis; advices of goods sent by carriers to be delivered with the goods gratis. Some persons are altogether prohibited from carrying letters even for nothing, unless the letters are such as are allowed in the previous exceptions. Among those so prohibited are carriers, owners, and masters of vessels passing from place to place in the British dominions, and passengers by such vessels.

Larceny in relation to the post-office is a serious offence, and punished with proportional severity. Every person employed under the post-office who, contrary to his duty, opens or detains a letter, or is accessory to its opening or detention, is guilty of a misdemeanour, and is liable to be punished by fine or imprisonment, or both. If he embezzle, secrete, or destroy a letter he is guilty of felony, and is liable to penal servitude for not more than seven, nor less than five years. If the letter contain any chattel or valuable article he may even be condemned to penal servitude for life. Equally severe punishments may be inflicted on those who commit thefts on the post-office, or knowingly receive articles stolen from the post-office, and who are not in its service. Any person who fraudulently retains or wilfully secretes, keeps, or detains a letter that ought to have been delivered to another person, or neglects or refuses to give up such a letter, is guilty of a misdemeanour punishable with fine and imprisonment. Telegraphic despatches are put nearly on the same footing as letters, but articles sent through the book-post are

on a somewhat different footing. Any post-office employee embezzling, secreting, or destroying an article of the latter description is only guilty of a misdemeanour punishable by fine or imprisonment or both. Any officer of the post-office who grants or issues a money-order with a fraudulent intent is guilty of felony, and is liable to penal servitude for not more than seven, nor less than five years, or imprisonment for any term not exceeding three years. The best source of information with regard to the British post-office is the British Postal Guide.

International postage was first provided for by the government of Great Britain in 1630, when Charles I. in connection with Louis XIII. of France established a post between London and Paris. Postal conventions are now in existence between Great Britain and almost every other country in the world. The rates for foreign, as also for colonial, letters, are of course higher than for inland letters, and the regulations regarding them are in many cases different. In recent years an immense stride has been taken in the improvement of postal communication between different countries by the formation of the international postal union. The first congress held with this object met at Paris in 1863, but adjourned till 1874 without effecting anything. In the latter year it met again at Bern, and concluded its sittings in October, 1874. The congress consisted of representatives of all the European states, besides Egypt and the United States, and drew up a convention which was to form the basis of the union aimed at, and which afterwards received the ratification of the different governments. The convention came into force on the 1st of July, 1875, for all the countries represented at the congress except France, which did not join the union till the 1st of January, 1876. According to the resolutions embodied in this convention all the states between which it is concluded form a single postal territory, having a uniform charge for the letters, book-post packets, samples, &c., passing between the several states of which it is composed. Since its foundation, however, the union has been joined by various other states in other parts of the world, some of which have acceded to it on the same terms as the states of which it was originally formed, while others have done so under a higher scale of charges. The countries and places belonging to the union under the lower tariff are, besides all the countries in Europe, Russia in Asia, Turkey in Asia, Persia, Egypt, Algeria, the Azores, Madeira, Marocco, the Spanish possessions on the north coast of Africa, Tunis, Tripoli, Canada, Newfoundland, the United States of America, Marquesas Islands, and Tahiti. Those under the higher tariff are Aden, British India, Ceylon, Hong-Kong, with the chief ports in China open to foreign commerce, Labuan, the Straits Settlements, Japan, the Philippine Islands, Mauritius, with the Seychelles, &c., Zanzibar, Gambia, Gold Coast, Lagos, Liberia, Sierra Leone, the Bermudas, Jamaica, British Guiana, Honduras, Ecuador, Mexico, Trinidad, Brazil, Peru, the Argentine Republic, Uruguay, Venezuela, and the Danish, Dutch, French, Portuguese, and Spanish colonies and dependencies, except those already mentioned as under the lower tariff. Outside of the postal union there still remain the Australian Colonies, Cape Colony, and Natal, &c. The rates in the United Kingdom for things addressed to countries under the lower tariff are for prepaid letters, $2\frac{1}{2}d.$ per $\frac{1}{2}$ oz., post-cards $1d.$, book-packets, samples, &c. $\frac{1}{2}d.$ per 2 oz., newspapers $1d.$ per 4 oz. each. The rates for countries under the higher tariff are, for letters, $4d.$ per $\frac{1}{2}$ oz., post-cards $1\frac{1}{2}d.$, book-packets, patterns, &c. $1d.$ per 2 oz.; newspapers $1d.$ per 4 oz. each. Higher rates are charged for transmission *via* Brindisi. Double postage is charged for letters not prepaid addressed to countries under the lower tariff, and a rate a half higher than the ordinary rate for those addressed to countries under the higher tariff. Articles sent by the book, newspaper, or pattern post are not sent at all unless prepaid, or if insufficiently prepaid. For every 300 nautical miles of sea-carriage an additional rate, not exceeding half the ordinary rate, may be imposed. The maximum weight of articles that may be conveyed by the book-post is fixed by the convention at 1000 grammes ($2\frac{1}{5}$ lbs.), and the maximum for the sample post at 250 grammes ($\frac{11}{20}$ lb.). For registered letters there is an extra charge of $2\frac{1}{2}d.$, and in case of loss, the loss is made good to the sender up to £2. Each postal administration in the union retains the charges originally levied within its boundaries. A congress of plenipotentiaries of the countries composing the union is to meet at least once in three years, to consider the working of the system, and introduce any improvements that may be thought necessary. In 1882 the number of letters that passed through the post in all the countries of Europe exceeded 3500 millions, besides which there were about 800 million samples, &c., and 1500 million newspapers, making a total of nearly 6000 millions of articles.

The earliest postal system in France that had any degree of permanence was established by the University of Paris. From the end of the thirteenth century this institution maintained couriers, who at certain times took charge of letters and money for the students collected in that city from almost all parts of Europe. Louis XI. established for his own use mounted messengers, and by an edict of June 19, 1464, instituted post stations at intervals of 4 leagues on the chief roads of France. This system was continued under the following reign, and ultimately private persons began to make use of the royal couriers for the transmission of their own correspondence, and the journeys of these couriers, which had hitherto taken place only when the wants of the court required, now became periodical. During the reign of Louis XIII., 1610–30, the French system of posts received a more regular form from the establishment of a controller-general of posts. They, as well as the postmasters named in 1630, received the revenue, till at length the minister Louvois, in the reign of Louis XIV., farmed out the posts to a certain Patin, and committed to him the regulation of the postage. In 1688, when the post was farmed out for the third time, the revenue amounted to 1,400,000 francs, and in 1695, when it was sold by auction unconditionally, to 2,000,000 francs. In 1733 this revenue amounted to 3,000,000, principally because the regency in 1719 had abolished the academical couriers (on which account the university at Paris had assigned to it, from the revenue of the post-office, 300,000 francs yearly, which was paid to it till the beginning of the revolution). In 1738 the post establishment was taken under royal management, in order that the government might find out the true income. The result of this was an increase of the sum at which it was farmed out. In 1786, when it was leased for the twenty-third time, the sum paid amounted to 10,800,000 francs. At the expiration of the last lease in 1791, when the establishment reverted to the king, it produced a clear income of more than 11,000,000 francs.

The postal reform introduced into England by Sir Rowland Hill was to some extent adopted in France by the decree of the 14th of August, 1848, which came into operation on the 1st of January, 1849. The charge for a single letter was then reduced to 20 centimes ($2d.$). In respect of cheapness of letter-carriage France is still behind other countries, and

in recent years has even receded. In 1871 the postal rates were raised one-fourth, and now stand at 25 centimes (2½*d.*) for prepaid letters not exceeding 10 grammes (a little above ⅓ oz.) in weight; 40 centimes (4*d.*) for letters above 10 grammes, but not above 20 grammes; 70 centimes for letters above 20 grammes, but not above 50 grammes; and so forth. Higher rates are charged when the letters are not prepaid, but the rule of double postage in such cases has not been adopted. The result of these high rates is that while in Great Britain 34 letters are annually sent through the post-office for each of the inhabitants, only 16 are so sent in France. During the investment of Paris by the German troops in 1870–71 experiments were made with balloons as means of communicating with the provinces. In this way 2,500,000 letters are said to have been forwarded while the siege lasted. The attempts to convey intelligence from Tours, where the government was then temporarily established, to Paris by means of carrier-pigeons, were less successful. Of 200 pigeons that were let off only seventy-three are said to have reached their destination. They carried despatches photographically reduced of 30,000 to 60,000 words in length.

In Germany the first post was established in Tyrol in the latter half of the fifteenth century, by Roger I., count of Thurn, Taxis, and Valsassina. His son established another from Brussels to Vienna in 1516, by the wish of the Emperor Maximilian I. In 1522 a post was established between Vienna and Nürnberg, where the diet sat, on account of the war with Solyman II.; but it ceased with the war. Charles V. was anxious to have news as quickly as possible, on account of the vastness of his states, and caused Leonard of Thurn and Taxis to establish a permanent riding-post from the Netherlands through Liége, Trèves, Spire, and Rheinhausen, through Würtemburg, Augsburg, and Tyrol to Italy. In 1543 Leonard was appointed postmaster-general of the empire. After the death of Charles V. the members of the empire were unwilling to allow a Spanish-Netherlandish post (such was that established by Charles V.) in their territories; yet Ferdinand I. confirmed Leonard in 1563. In 1595 he was appointed postmaster-general of the empire, in opposition to the wishes of the members; but several of them having already established posts in their dominions refused to acknowledge the exclusive privileges claimed by the imperial post. In 1615 Lamoral of Taxis was actually infeoffed with the imperial post as an imperial fief. Ferdinand II. extended this grant so as to make it descend to the nieces of Lamoral, and a regular post now went every week from the imperial court, and also from Rome, Venice, Milan, Mantua, &c., to Augsburg, and thence to Brussels and back. The post remained as long as the empire existed, one of its many ill-defined and unwieldy institutions, in which private or petty interest was allowed to stand in the way of the public welfare. The post was actually made a regular point in the *Wahlcapitulationen*, the stipulations between the electors and the candidate for the imperial dignity. The imperial posts were restricted, and the emperor himself excluded the Thurn and Taxis post from several of his dominions. In a country where so many small territories had their own posts it was natural that they should remain in a very bad condition, and it is only in recent times that they have been greatly improved, more especially in consequence of the general adoption of the Austro-German compact, by which the international posts were placed under one system of management. Impediments to the free development of the postal system still continued from the circumstance that in Hesse, Nassau, in the states of the Saxon-Ernestine line, Hohenzollern, Waldeck, &c., the post was left to the house of Thurn and Taxis as a fief. In some other states the Thurn and Taxis post was founded upon a regular compact. In 1867, however, the Thurn and Taxis system was abolished, and a uniform rate of 1 silbergroschen or 3 kreuzers (about 1*d.*) for a single letter was fixed for the whole of North Germany. Since the recent establishment of the German Empire a uniform postal and telegraphic system has been organized for the whole of Germany, and the passing of postal laws is now exclusively an imperial matter. The supreme administration resides in the emperor. Bavaria and Würtemberg still retain the management of their posts, however, and can make what arrangements they please with regard to their internal communications, or to their own immediate intercourse with neighbouring states not belonging to the empire. Postal treaties unite Germany to the Austro-Hungarian monarchy and Luxemburg. In some respects the German postal system affords greater facilities to the public than are granted by those of other countries. If any person wishes to communicate something to all the post-offices of a certain line (for example, an inquiry after an important parcel), an open paper may be sent by mail, which is read and forwarded by all the respective postmasters. A receipt for the delivery of any letter purporting to contain a particular sum may always be had, and this sum is paid if the letter is lost in the regular course of transportation. If the letter, however, should arrive in good order, and no money be found in it, the government would not be answerable in consequence of such a receipt. But if a man goes to the post-office with an open letter, and incloses a certain sum therein in the presence of the postmaster, the receipt of the government makes him liable, at all events, for the safe transportation of the money. To Germany is also due the introduction of post-cards, which were first proposed by Prussia at a postal conference held at Karlsruhe in 1865. A signal proof of the energy of the management of the post-office in Germany was given during the Franco-German war of 1870–71, in the establishment of the field-post, by which the troops in the field were enabled to communicate with their friends at home with as much regularity as if they had been stationed in towns of Germany. Large quantities of letters were despatched by this post at one time; on the 14th of January, 1871, for example, 267 letter-bags containing 160,000 letters.

The postal system of Italy arose in Piedmont. Until 1561 the transmission of letters was in the hands of the communes or private persons, who were authorized by the state to charge for the service a sum which varied according to circumstances. In the year mentioned the posts were farmed out by Emmanuel Philibert, duke of Savoy, to a postmaster-general. This arrangement continued till 1697, when Duke Victor Amadeus II. added the proceeds of the post-office to the revenue of the state, an indemnity being paid to the postmaster, who had the farming of them. From 1710 downwards the post-office was administered directly by the state. In 1818 the system of Piedmont was reorganized, and since the unification of Italy it has been extended to the whole kingdom.

The earliest mention of the establishment of a post-office in the British colonies of North America occurs in the General Court Records of Massachusetts of 1639, where we find the following entry:—'It is ordered that notice be given that Richard Fairbanks, his house in Boston, is the place appointed for all letters which are brought from beyond the seas, or are to be sent thither, which are to be left with him; and he is to take care that they are to be delivered or

sent according to the directions; and he is allowed for every letter 1*d.*, and must answer all miscarriages through his own neglect in this kind, provided that no man be compelled to having his own letters except he please.' In 1672 Governor Lovelace of New York instituted 'a post to goe monthly' from New York to Boston and back; and in 1683 a post-office was established in Pennsylvania by the celebrated William Penn. In 1692 Thomas Neal was appointed by letters-patent postmaster-general, with authority to erect post-offices throughout the American colonies; and the same year a post-office was established in New York. In 1693 the postal system was organized by a Scotchman, named Duncan Campbell. In the early part of the last century the mail was conveyed twice a month in stage-coaches between Boston, New York, and Philadelphia; and from New York to Albany by a foot-post once a month. A general post-office was established in Virginia in 1732, with a sub-office in each county. The celebrated Benjamin Franklin was appointed postmaster at Philadelphia in 1737, and in 1753 postmaster-general to the American colonies, an office which he continued to hold till 1774, when he was dismissed by the British government. Numerous improvements were made during his management. The following are the principal postal regulations in the Union as revised under act of March 3, 1883. All mail matter is divided into four classes. The first class includes letters, post-cards, and anything closed against inspection, or containing writing not allowed as an accompaniment to printed matter: postage, 2 cents each half oz. or fraction thereof; post-cards, 1 cent; registered letters, 10 cents in addition to postage. Second class matter includes all newspapers, periodicals, or matter exclusively in print, and issued at stated intervals, as frequently as four times a year from a known office of publication: postage, 2 cents per lb. or fraction thereof. Mail matter of the third class includes books, transient newspapers and periodicals, circulars, and other matter wholly in print, legal and commercial papers filled out in writing, proof-sheets and copy accompanying the same: postage, 1 cent for each 2 oz. or fractional part thereof (manuscript unaccompanied by proof-sheets charged letter weight); limit of weight, 4 lbs. each package. The fourth class embraces merchandise and all matter not included in the other three classes which is not liable to injure the mail matter; postage, 1 cent per oz. or fraction thereof; limit of weight, 4 lbs. Prepayment of postage by stamps for all classes of matter is required. The free delivery of mail matter at the residences of the people desiring it is required by law in every city of 50,000 or more population, and may be established at every place not inhabited by less than 20,000.

In most of the South American republics the postal system is as yet far from being well organized. This is almost equally true of Brazil; but a somewhat better state of matters prevails in Chili and Bolivia. In Asia the postal service is carried on for the most part by agencies of European states. England has post-offices in Hong-kong and Shanghai, besides its Indian dominions; France in Beyrut, in Bien-Hoa, and Saigon in Cochin-China; in Chandernagore, Pondichéry, and Carical in India. Between Russia and China there is a post served by Mongols. In the rest of China there is no postal system in the modern sense of the phrase, although a body of couriers exists for the purpose of conveying government despatches to the different parts of the empire. Japan has recently introduced a postal service between Yokohama and Nangasaki. In Africa there are the beginnings of a postal organization in Egypt, as also (since November, 1871) in Marocco. A postal system has also been set up by the French in Algeria.

POST-OFFICE INSURANCE. This department of the post-office, the duties of which include the issuing of government annuities as well as of life-assurance policies, was first fully organized in 1865. Annuities, either immediate or deferred, to the amount of £50, payable half-yearly, and deferred monthly allowances to the amount of £4, 3*s.* 4*d.*, may be purchased for any person of ten years of age and upwards. The sum payable for an annuity or monthly allowance varies of course with the amount of the annuity or allowance, and the age and the sex of the person on whose life it is to be paid. Deferred annuities may be purchased either by a single payment or by periodical payments terminating at the time when the annuity becomes payable. By paying higher premiums the person on whose life the annuity depends may secure the repayment to his or her representatives of all the premiums paid up to his or her death, if that event should take place before the annuity becomes due. A similar provision is made with regard to monthly allowances. Policies of insurance for sums not less than £20, nor more than £100, may be issued to any person between the ages of sixteen and sixty, and the premiums may be paid by yearly, half-yearly, quarterly, monthly, or fortnightly instalments, provided that no payment be less than 2*s.* Annuities and insurance policies may be obtained from any post-office throughout the kingdom, the postmaster of which is authorized to issue them. In 1882 this department issued 234 insurance policies, the sum assured by which was £8446; 799 immediate annuities, representing a total annual payment of £13,435; and 31 deferred annuities to the value of £561. Complete tables of the premiums payable in this department are sold by the government printers, Messrs. Eyre and Spottiswoode, for 5½*d.*, and may be seen without charge at any of the local post-offices. Consult also the British Postal Guide.

POST-OFFICE SAVINGS-BANKS. See BANK.

POSTULATE (from *postulo*, to demand), in mathematics, a problem which it is self-evident can be solved; as, for example, to draw a line about a point so that every part of the line shall be at an equal distance from the point.

POSTULATION, in canon law, an appeal to an ecclesiastical superior to remove a disability by which any one who has been appointed to a benefice is prevented from accepting it. The term was formerly also applied to the method by which a bishop was transferred from one see to another. The canon law declared that a person once elected could not be elected again; and when an electoral college desired the bishop of another see to fill a vacancy in their own see, they petitioned the bishop to make the change, and if he consented he was translated. No postulation could be made unless the electoral college were unanimous, while in the case of an election a majority was sufficient.

POSTURES, in the ecclesiastical sense of the word, the attitudes assumed in worship, especially in prayer. Among the early Christians kneeling seems to have been the ordinary posture in prayer, except in Easter-time and on Sundays, when those engaged in this exercise stood, to symbolize, it is said, the resurrection of Christ. In the ordination of subdeacons, deacons, and priests in the Roman Catholic Church the prostrate attitude is assumed by those undergoing the ordinance. In the same church public prostration is sometimes also required of penitents, that is, those subjected to penance.

POTAMOGETON, a genus of plants belonging to the natural order Naiadaceæ. It has a perfect

flower, a four-pointed perianth, four sessile anthers, four ovaries, and four drupes or nuts. All the species are water-plants, and often present as beautiful an appearance in clear streams and ponds as the fuci do in the sea. They protect the spawn of fish, and harbour innumerable aquatic animals, while their roots and seeds afford food to water-birds. (Brit. Flora.)

POTASH, or POTASSA, derives its name from *ashes*, and the pots (called *potash kettles*) in which the lixivium from which it is obtained is boiled down. Some of its old names were *vegetable alkali*, in allusion to its being derived from the incineration of vegetables; *salt of tartar*, from the fact that cream of tartar is another source of potash; and *alkali of nitre*, from its having been known to form the basis of that salt. The process employed in the arts for obtaining potash is the following:—The ley of vegetable ashes is mixed with quicklime and boiled down in iron pots, and the residuum ignited; the substance remaining after ignition is common potash. Those ashes which are derived from plants growing remote from salt water yield this alkali in greatest purity. Herbaceous vegetables yield more than trees; in trees, the branches yield more than the body, the small branches more than the large, and the leaves most of all. One thousand pounds of the following vegetables yielded saline matter in the following order:—

Wormwood,	748
Stalks of sun-flower,	349
Stalks of Turkey wheat,	198
Vine branches,	162
Fern,	116
Box,	78
Fumitory,	369
Beech,	219
Elm,	166
Fir,	132
Oak,	111
Heath,	115
Aspen,	61

The alkali arises from various salts existing in the vegetable juices, which have been decomposed by the action of fire. To prepare the potash in a state of perfect purity, from the impure article bearing this name in commerce, common potash is boiled with twice its weight of quicklime for a few hours in abundance of water—the precipitate is separated, and the liquid is boiled down to the consistence of a syrup; after which an equal bulk of strong alcohol is added, and the mixture is allowed to stand some time in a closed vessel. Some solid matter will collect at the bottom of the vessel, above which will appear a stratum of watery liquor containing several salts in solution; while the alcohol occupies the top, and is coloured dark red. This last is separated from the fluid below by decantation, and is evaporated to dryness in a silver basin. The dry substance is hydrate of potash, or caustic potash, KHO. It is solid, white, and extremely caustic. In minute quantities it changes the purple of violets and cabbage to green, reddened litmus to purple, and yellow turmeric to reddish-brown. It rapidly attracts humidity from the air, and becomes semi-fluid. It is fusible at a heat of 300°, and is volatilized at low ignition. It is used in surgery under the name of *lapis infernalis* or *lapis causticus*. In chemistry it is very extensively employed, both in manufactures and as an agent in analysis. It is the basis of the common soft soaps, for which purpose, however, it is not used in its pure state. Potash is also manufactured from the ashes of marine plants. The plants are burned in large heaps, and the residue, called *kelp*, is repeatedly lixiviated with water; from this solution the potash is obtained by evaporation. Salt springs also yield this substance, which is likewise obtained in large quantity from the mineral deposits of Stassfurth, near Magdeburg. The name potash is applied not only to that substance to which it properly belongs, namely, oxide of potassium, but also, and more frequently in commerce, to the carbonate of the same metal.

Decomposition of Potash.—If a thin piece of solid hydrate of potash be placed between two discs of platinum, connected with the extremities of a voltaic apparatus of 200 double plates, 4 inches square, it will soon undergo fusion, oxygen will separate at the positive surface, and small metallic globules will appear at the negative surface, which are the basis of potash, and are called by Sir H. Davy, who discovered the fact in 1807, *potassium*. Other and more convenient methods have been devised for obtaining this metal. That invented by Messieurs Gay-Lussac and Thénard consists in heating potash to whiteness in a gun-barrel, in contact with turnings of iron, the air being excluded; the potassium is liberated and collects in the cold extremity of the tube. The process of Brunner, as improved by Maresca and Donné, consists in calcining crude tartar (acid tartrate of potassium) in a covered vessel so long as vapours are given off. The mass, which contains a mixture of charcoal and carbonate of potassium, is now introduced into an iron bottle connected by a short iron tube a few inches in length with a receiver. The receiver consists of two pieces of wrought-iron 12 inches long and 5 inches wide, clasped together so as to form a shallow box ¼ inch deep. The receiver is open at both ends. On heating the iron bottle to a high point fumes of potassium begin to appear at the mouth of the tube; the receiver is now adjusted to the tube, and in it the metal is condensed. During the operation fumes of carbonic oxide are evolved, which are very liable to combine with the potassium and so to form a very explosive substance. To guard against the formation of this compound, the iron tube connecting the bottle with the receiver must be kept very hot. As soon as a sufficient quantity of potassium has condensed the receiver is removed, plunged beneath the surface of rectified naphtha, and when quite cold the potassium is removed. As thus obtained the metal is not pure; it must be again distilled. Potassium is possessed of the following properties:—It is lighter than water, its specific gravity being only 0·86. At common temperatures it is solid, soft, and easily moulded by the fingers. At 150° it fuses, and at a heat a little below redness it rises in vapour. It is opaque. When freshly cut its colour is bright silver-white; but it becomes tarnished on a moment's exposure to the air. To preserve it unchanged it must be kept in small vials under naphtha or oil of copaiba. It conducts electricity, like the common metals. When thrown upon water it decomposes that liquid with evolution of hydrogen, which burns with a pale violet flame, owing to the presence in it of potash vapour. The water becomes a solution of potash. When moderately heated in the air it inflames, burns with a red light, and throws off alkaline fumes. Placed in chlorine, it burns with great brilliancy. On all fluids containing much water, oxygen, or chlorine it readily acts. It combines with oxygen in three proportions. The *protoxide* (K_2O) is obtained by the action of dry air, free from carbonic acid, upon the metal in thin slices. When potassium burns in open air, or in oxygen gas, it is converted into an orange-coloured substance, which is the *peroxide* of potassium. It may also be formed by conducting oxygen gas over potash at a red heat. It has the formula K_2O_4. The intermediate oxide, K_2O_2, has not been obtained in a perfectly pure state. The attraction of chlorine for potassium is much stronger than that of oxygen for this metal. *Chloride* of potassium (KCl) has a

saline and bitter taste. *Iodide* of potassium (KI) is formed with the emission of light, when potassium is heated in contact with iodine. It fuses readily when heated, and is volatilized at a temperature below redness. It dissolves in strong alcohol; and the solution, when gently evaporated, yields small colourless cubic crystals of iodide of potassium. By the aid of a little heat sulphur unites readily with potassium, and forms a *sulphide* of this metal; and so much heat is evolved at the moment of combination that the mass becomes incandescent. It has a red colour, fuses before the temperature of ignition, and assumes a crystalline texture in cooling. It has the formula K_2S. Other sulphides of potassium are known. *Phosphide* of potassium may be formed in like manner by the action of potassium on phosphorus, with the aid of a moderate heat. Charcoal, which has been strongly heated in contact with potassium, effervesces in water, rendering it alkaline, though the charcoal may be previously exposed to a temperature at which potassium is volatilized. Hence there is probably a compound of the two formed by a feeble attraction.

Carbonate of potassium. This is the *pearl-ashes* of commerce. It is obtained by heating the crude potash in a reverberatory furnace, and stirring it briskly for some time at a white heat. From the predominance of the alkali in it it is deliquescent; if exposed to the air, it soon attracts its weight of water, which is the quantity necessary for its complete solution. Its taste is acrid; it changes the vegetable colours to green, and combines with oils. These characters are so distinctly alkaline that they formerly led to the opinion that the potash was in excess in the salt, and hence it was termed a subcarbonate; now, however, it is known that it is a normal carbonate, and that its formula is K_2CO_3. It is decomposed by acids, carbonic acid being disengaged with effervescence.

Bi-carbonate of potassium may be obtained by exposing a solution of the carbonate to the air for some time, carbonic acid being imbibed from the atmosphere, and crystals being deposited; or it is formed more directly by passing a current of carbonic acid gas through a solution of the carbonate of such a strength that crystals form spontaneously. They are much more soluble in hot water than the normal carbonate—the water taking up five-sixths of its weight; but if the temperature be that of boiling water, part of the carbonic acid is driven off in the gaseous state. The taste of this salt is more mild than that of the pearl-ashes; though still alkaline, it has no causticity, but it changes the vegetable colours to a green. It contains just double the quantity of carbonic acid in the carbonate of potassium, and has the formula $KHCO_3$. It is much used for medicinal purposes.

Nitrate of potassium, nitre, or *saltpetre*, is a white, translucent, or transparent salt, usually crystallized in distinct six-sided prisms with dihedral summits. Its taste is penetrating; but the cold produced by placing the salt to dissolve in the mouth is such as at first to predominate over the acid. Seven parts of water dissolve two of nitre at the temperature of 60°, but boiling water dissolves its own weight. Its constituents are nearly equal weights of nitric acid and potash. Its formula is KNO_3. On being exposed to a gentle heat it fuses; and in this state being poured into moulds, so as to form little round cakes or balls, it is called *sal prunella* or *crystal mineral*. Nitre powerfully promotes the combustion of inflammable substances. Two or three parts mixed with one of charcoal, and set on fire, burn rapidly; nitrogen and carbonic acid gas are given out; and a small portion of the latter is retained by the alkaline residuum, which was formerly called *clysmus of nitre*. Three parts of nitre, two of carbonate of potash, and one of sulphur, mixed together, form the *pulvis fulminans*, a small quantity of which, laid on a fire-shovel, and held over the fire till it begins to melt, explodes with a loud, sharp noise. Mixed with sulphur and charcoal it forms *gunpowder* (which see). Three parts of nitre, one of sulphur, and one of fine saw-dust, well mixed, constitute the *powder of fusion*. If a bit of base copper be folded up and covered with this powder in a walnut shell, and the powder be set on fire with a taper, it will detonate rapidly, and fuse the metal into a globule of sulphide, without burning the shell. The sources of nitre are as follows:—It is found ready formed in the East Indies, in Spain, in the Kingdom of Naples; and it abounds in the limestone caves of the western and south-western states of America, in which last-mentioned situations it is rarely found ready formed, but is obtained from the nitrate of lime by decomposing it with carbonate of potassium. Large quantities of so-called Chili saltpetre or nitrate of sodium are now imported from South America. Far the greater part of the nitrate made use of is produced by a combination of circumstances which tend to compose and condense nitric acid. This acid appears to be produced in all situations where animal matters are completely decomposed with access of air, and of proper substances with which it can readily combine. Ground frequently trodden by cattle, and impregnated with their excrement, or the walls of inhabited places where putrid animal vapours abound, such as slaughter-houses, drains, or the like, afford nitre by long exposure to the air. Artificial nitre beds are made by an attention to the circumstances in which the salt is produced by nature. Dry ditches are dug, and covered with sheds, open at the sides, to keep off the rain; these are filled with animal substances of all kinds, and occasionally watered, and turned up from time to time to accelerate the process by increasing the surfaces to which the air has access. When a certain portion of nitrate is formed, the process appears to go on more quickly; but a certain quantity stops it altogether, yet after this cessation the materials will go on to furnish more, if what is formed be extracted by lixiviation. After a succession of many months, more or less, according to the management of the operation, in which the action of a regular current of fresh air is of the greatest importance, nitre is found in the mass. If the beds contained much vegetable matter a considerable portion of the nitrous salt will be common saltpetre; but if otherwise, the acid will, for the most part, be combined with calcareous earth, to extract the saltpetre from which a number of large casks are prepared, with a cock at the bottom of each, and a quantity of straw within to prevent its being stopped up: into these the matter is put, together with wood-ashes, either strewed at top or added during the filling. Boiling water is then poured on, and suffered to stand for some time, after which it is drawn off, and other water added in the same manner, as long as any saline matter is obtained. The weak brine is heated, and passed through other tubs, until it becomes of considerable strength; it is then carried to the boiler. It contains nitre and other salts, the principal one of which is common salt. It is a property of nitre to be much more soluble in hot than in cold water, as has been seen above; but common salt is very nearly as soluble in cold as in hot water. Whenever, therefore, evaporation is carried by boiling to a certain point, much of the common salt will fall to the bottom for want of water to hold it in solution, though the nitre will remain in solution. The common salt thus separated is taken out with a perforated ladle; and a

small quantity of the fluid is cooled from time to time, that its concentration may be known by the nitre which crystallizes in it. When the fluid is sufficiently evaporated it is taken out and cooled, and a great part of the nitre separates in crystals, while the remaining common salt continues dissolved, because equally soluble in cold as in hot water. Subsequent evaporation of the residue will separate more nitre in the same manner. By the suggestion of Lavoisier a much simpler plan was adopted; reducing the crude nitre to powder, and washing it twice with water. This nitre, which is called *nitre of the first boiling*, contains some common salt, from which it may be purified by solution in a small quantity of water, and subsequent evaporation; the crystals thus obtained are much less contaminated with common salt than before. The *uses of nitre* are various. Besides being employed in the composition of fluxes, and for the purposes of metallurgy, it serves to promote the combustion of sulphur in fabricating sulphuric acid. It is used in the art of dyeing; it is added to common salt for preserving meat, to which it gives a red hue; it is prescribed in medicine as a cooling febrifuge and diuretic; and some have recommended it, mixed with vinegar, as a very powerful remedy for the sea-scurvy.

Sulphate of potassium (K_2SO_4) is formed by adding diluted sulphuric acid to a solution of carbonate of potash, until the acid and alkaline properties are neutralized. It crystallizes in six-sided prisms, with pyramidal terminations, and requires for its solution seventeen parts of water at 60°, and five parts at 212°. Its taste is bitter.

Bi-sulphate of potassium ($KHSO_4$) is the salt remaining after the decomposition of nitre by sulphuric acid. It contains twice the quantity of acid in the sulphate, has a very sour taste, and reddens vegetable colours, and is more soluble than the sulphate.

Chromate of potassium (K_2CrO_4) is soluble in water, and by evaporation affords prismatic crystals, which are not changed by exposure to the air.

Chlorate of potassium ($KClO_3$) may be formed by receiving chlorine as it is formed into a solution of potash. When the solution is saturated it may be evaporated gently, and the first crystals produced will be the salt in question. They are shining, hexahedral laminæ, or rhomboidal plates. Its taste is cooling and disagreeable. Specific gravity, 2. Sixteen parts of water at 60°, and two and a half of boiling water, dissolve one of it. The purest oxygen is obtained from this salt by exposing it to a gentle heat. Its effects upon inflammable substances are very powerful. Two grains, rubbed into a powder in a mortar, and mingled with one grain of sulphur, give a loud detonation when struck upon an anvil with a hammer. Five grains of the salt, mixed in the same manner with 2½ of charcoal, will be inflamed by strong trituration. If a little sugar be mixed with half its weight of the powdered chlorate, and a little strong sulphuric acid poured on it, a sudden inflammation will ensue. If to 1 grain of the salt in a mortar we add ½ grain of phosphorus, and communicate to it a slight trituration, it will detonate with great violence, and attended with some hazard to the operator from the jets of burning phosphorus. Chlorate of potash is decomposed by the acids, accompanied with the evolution of a dense yellowish-green vapour, which acts with great energy on inflammable substances. In this way a light may be easily obtained at any time by placing a few grains of the salt on a piece of paper, dropping a little oil of turpentine on them, and then adding a drop of strong sulphuric acid; the oil will be immediately inflamed, and will kindle the paper. In match-bottles, once common for procuring light, a mixture consisting of sugar, like that above described, except the presence of a little mucilage to form the compound into a paste, was spread over sulphur matches, which were dipped into a bottle containing a portion of strong sulphuric acid, retained by fibres of amianthus or spun glass.

Fluoride of potassium has a sharp taste, is deliquescent, very soluble in water, and not easily crystallizable.

POTASSIUM. See POTASH.

POTATO (*Solanum tuberosum*), a plant belonging to the natural order Solanaceæ. Mankind owe this invaluable esculent to the temperate regions of western South America, where it still grows wild, and where it was cultivated long previous to its introduction into Europe. The wild plant grows chiefly in steep rocky districts near the sea, and produces only small, tasteless, watery tubers; but, on the other hand, has sweet-smelling flowers; and although the flowers of the modern cultivated plant are scentless, Clusius, the first European who mentions the potato, describing in 1601 the first cultivated potatoes in Belgium, praises the sweet smell of their blossoms. The potato was introduced into Europe for the first time by the Spaniards after the conquest of Peru, by whom it was spread over the Netherlands, Burgundy, and Italy before the middle of the sixteenth century. In Germany it is first heard of as a rarity in the time of Charles V. Sir John Hawkins was the first to introduce the plant into Ireland (1565). Sir Francis Drake was the next Englishman who brought the plant from the New World; but Sir Walter Raleigh, who brought it from Virginia, was the first to make it well known in England. Although the potato was tolerably widely distributed on the continent of Europe before that date, it seems to have been cultivated more as an article of curiosity than as an article of food, and Ireland is said to have been the country in which it was first cultivated on a large scale as a means of subsistence. According to Alexander von Humboldt it was first so cultivated in England in Lancashire in 1684, and in Germany in Saxony in 1717. In the course of the eighteenth century it became a favourite article of food with the poorer classes in Germany; but in France there existed so violent a prejudice against it that it did not come into use until the reign of Louis XVI., towards the close of the eighteenth century, mainly in consequence of the efforts of Parmentier, who had learned to appreciate the advantages of the plant while a prisoner in Germany. Now the potato is almost universally cultivated within the tropics, and to lat. 64° N. in Sweden; and it seems to be adapted to all exposures and almost every soil. The potato has added millions to the population of Europe, and till the disease appeared had rendered famines far less frequent.

The potato tuber is the underground stem of the plant, rounded or oblong, almost always white internally, but differing in different varieties in the colour of the skin, which is of various mixtures of brown, purple, red, yellow, and white. The stems are angular, herbaceous, and from 1½ to 2 feet high. The leaves are pinnate, composed of five or seven lanceolate oval leaflets, having lesser ones between them. The flowers are pretty large, numerous, and disposed in corymbs upon long peduncles, which are inserted opposite to the superior leaves; their colour is violet, bluish, reddish, or whitish. The fruit is of moderate size, and reddish-brown when ripe. The potato succeeds best in a light sandy loam containing a certain proportion of vegetable matter. The usual mode of planting is by cutting the tubers in pieces, reserving one eye or bud to each piece, and covering these with earth. It used to be a more certain crop than any other, having little to fear from storms or hail, or

even from long droughts or continued rains. It is besides, of the various farm crops, planted latest, and thus gives a good opportunity of cleaning the ground. The varieties of the potato are very numerous, differing in the time of ripening, in their form, size, colour, and quality; and in general every district has its peculiar or favourite ones, and their names are quite arbitrary or local. In 1842 161 varieties of the potato were enumerated as having been previously or as being still cultivated in Europe, and the most of them in Great Britain. Ten years later the number had dwindled down considerably. At the latter date there were cultivated in Britain only a few of the early white-skinned varieties, a still smaller number of the late coarse white sorts, one red (the Orkney), one blue (the Jersey), and one garden red (the fortyfold), while all the fine old field sorts, such as the Yorkshire reds, Devonshire reds, Perth reds, blue dons, buffs, &c., had totally disappeared, leaving behind them only the reminiscence of what a richly-flavoured mealy potato really was. Some varieties degenerate and others improve by removal to another district. New ones are readily procured by sowing the seeds, which, with care, will produce tubers the third year, and a full crop the fourth. In addition to the usual culinary uses of potatoes, bread may be made by mixing with them a nearly equal portion of wheat-flour; and also a kind of cheese by reducing them to the consistence of paste, adding an equal quantity of curd, and with a little salt and some other ingredients mixing the whole together and forming it in moulds. Alcohol is very extensively distilled from the potato in Europe. Starch may be made by the simple process of scraping them in water and thoroughly washing the pulp, when the starch settles to the bottom in a dense sediment. This starch is not only used for the same purposes as that prepared from wheat, but also as a size, which does not putrefy like that produced from animal substances, and has no disagreeable smell. Yeast may also be prepared from the potato, and even the seed-vessels may be employed as a pickle.

Like all plants that are extensively cultivated, and under very different circumstances of soil, climate, and artificial treatment, potatoes are extremely subject to disease. Of some of these diseases comparatively little is known, owing to the want of careful observations and the limited knowledge of organic chemistry at the time when they appeared. The most formidable of the diseases to which the potato was liable before the appearance of the dry and wet rot and the potato murrain, or what is usually spoken of as the potato disease, were curl and scab. The principal feature of the former of these two diseases, that from which it gets its name, is the curling of the shoots soon after their first appearance. After this symptom has manifested itself the shoots make little progress, and sometimes disappear altogether. The plants affected by it produce no tubers, or only a few minute ones, which are hard and unfit for food. The disease was first generally noticed in the year 1764, and was extremely prevalent in England towards the end of last century. It is attributed to the gradual weakening of the plant by constant propagation from cuttings instead of from seed. The scab is a disease which attacks the tubers, which become covered with brown spots on the outside, while underneath the skin is a fungus called *Tubercinia scabies*. The first detailed description of the disease known as *dry-rot* is to be found in a memoir published by Martius at Munich in 1842. The disease had been prevalent in Germany since 1830, committing great ravages there, especially in the south. It is characterized by a hardening of the tissues, which are completely gorged with mycelium (the vegetative part of fungi), which is often very closely compacted, and which at length bursts forth in the form of little white cushion-shaped tufts loaded with fructification. The whole tuber sometimes becomes so hard as to make it difficult to break it even with repeated blows of a hammer. It is constantly accompanied by a fungus, called by Martius *Fusisporium solani*. In the disease called *wet-rot* the potato is affected much in the same way as by the dry-rot; but the tubers, instead of becoming hard and dry, are soft. The fungus which is present in wet-rot, although different in appearance from that which accompanies dry-rot, is yet supposed to be the same plant, which in different stages of development is referred to the genera *Sporotrichum*, *Dactylium*, *Fusarium* or *Fusisporium*, and *Periola*. The potato murrain, or potato disease *par excellence*, was first observed in a serious form in Great Britain in the year 1845, though there were slight indications of it one or two years before. In the year 1844 it was most disastrous in America, and it appears to have been known for ages on the western coast of that continent. Usually the first sign of disease is the appearance of brown patches upon the haulms and leaves. In some early varieties of potato, such as the ash-top, there does not appear in many instances to be any previous disease of the leaves; but then in these cases the tubers are not diseased till the prevalence of the disease in other later varieties, and inasmuch as the tubers are merely underground shoots, it does not seem very surprising that though the leaves had perished before the season in which those of other varieties were first attacked, the tubers should afterwards become so. The first spots indicative of disease appear upon the leaves towards the commencement of autumn, and when carefully examined are found to be surrounded by a ring of a paler colour than the body of the spots, and the whole of this outer ring is frosted with a fungus called the *Botrytis infestans*, which is a constant accompaniment of the disease, if not its cause. If the weather be dry the progress of the disease is slow, but if a moist warm day supervene it will be found on carefully examining the brown specks at different hours of the day that the mould spreads with great rapidity, destroying all before it, or converting the green cells into brown. The separate spots soon become confluent; the evil extends to the stems, and if the weather be favourable to its progress the whole becomes in a few days corrupt or putrid. The same parasitic fungus that is found on potatoes affected by the potato murrain has been found also within the berries of diseased tomatoes and on the leaves of a few Solanads, but not on plants of any other family. Of the plans adopted for mitigating the potato disease, or preventing it from affecting the tubers, the most approved is that of pulling up the stalks by the root as soon as the first rumour of its approach is heard. If the leaves are already spotted before this is done, it is rarely effectual. But few farmers can be prevailed upon to pull up the haulms as soon as the disease manifests itself in neighbouring localities, because in the first place their crops may in a great measure escape, and they would be greatly diminished in weight if this plan were resorted to; and in the second place the starch-mills always afford a market for diseased potatoes, since the disease does not affect the quality of the starch that may be obtained from the tubers. Other plans are therefore more commonly adopted. The most successful of these is that recommended by Mr. Meyer and Mr. De Lomber, which consists in laying down the potato-stalks on each side of the drill, and covering the whole of them up with earth except the very tips of the haulm. As a means of fortifying potatoes against attacks of

the disease, it is by some theorists and cultivators thought advisable to avoid all undue forcing of the crop by too rich and abundant application of ammoniacal manures.

POTATO-FUSEL-OIL, a disagreeably smelling liquid obtained in the alcoholic fermentation of potatoes. It consists chiefly of ethylic and amylic alcohols, especially the latter. See FUSEL-OIL.

POTEMKIN, GREGORY ALEXANDROVICH, the most famous of the favourites of the Empress Catharine II., born near Smolensk, in 1736; died in Bessarabia in 1791. He was descended from an ancient Polish family, and while still young obtained an ensigncy in the horse-guards. Soon after the accession of Catharine he attracted the attention of his sovereign, who appointed him colonel and gentleman of the chamber. In the war against the Turks in 1771–72 he served under Romanzoff, and acquitted himself so well that he was rewarded with the rank of lieutenant-general. Soon after he gained the entire confidence of Catharine, and became her avowed favourite. From 1776, after he had managed to supplant the brothers Orloff, his chief rivals for the favour of the empress, till his death, a period of more than fifteen years, he exercised a boundless sway over Catharine and the destinies of the empire. In 1783 he suppressed the nominally independent khanate of the Crimea, and annexed it to Russia. This, however, was not effected without resistance, to overcome which Potemkin resorted without scruple to the most sanguinary measures. In order to secure his conquest he then created a larger army than Russia had hitherto possessed. In 1787, being desirous of expelling the Turks from Europe, he stirred up a new war, in the course of which, at the head of the main body of the Russian army, he took Oczakoff by storm (1788). In the following year (1789) he took Bender, but as the finances of Russia were by this time exhausted Catharine was desirous of peace. Potemkin, however, was resolved on conquering Constantinople, and resisted the proposal to enter on negotiations with the enemy. Seeing his views disregarded he started for St. Petersburg, hoping by his presence to win over the empress to his side (March, 1791); but Catharine took advantage of his departure from the scene of action to send plenary powers to Prince Repnin, who, after once more defeating the Turks, dictated a peace, the preliminaries of which he signed. Meanwhile he was entertained by Catharine with splendid festivals and loaded with gifts, but hearing of the steps that had been taken at the seat of war, he at once repaired thither, vowing to undo the work of his substitute. He reached Jassy, but afterwards set out from thence to Nicolaieff, with what object is not known, and died on his journey thither. His body was carried to Cherson, where the empress appropriated 100,000 roubles for the erection of a monument to him, which was never completed. Afterwards, the Emperor Paul caused the corpse of his mother's favourite to be taken from its coffin, and thrown into the ditch of the fortification. The Emperor Alexander at last awarded his bones a decent burial. Satiated even to disgust with sensual pleasure, Potemkin denied himself nothing, and satisfied every passing whim by a prodigal waste of the money of the state, and a wanton sacrifice of the lives of others. Though the empress denied him nothing, and the sums of money which she expended on him exceeded all belief, still he was mean enough to appropriate to himself the money intrusted to him for other purposes, and even to forge orders on the treasury, in the name of the empress, in order to obtain for himself the money which was necessary for supplying the wants of the state. Potemkin also suffered himself to be purchased by foreign powers. While possessed of incredible wealth, and throwing away the largest sums at the gaming table, or in the gratification of his whims, he did not pay the bills of those who furnished his ordinary supplies. Those tradesmen considered themselves ruined who received orders to furnish goods to Potemkin.

POTENTIAL, a function which has been of marvellous power in developing the mathematical theories of gravitation, electricity, magnetism, fluid motion, the conduction of heat, &c. It was first introduced for gravitation by Laplace, but the name was first given to it by Green in his essay On the Application of Mathematical Analysis to Electricity. Green may be said to have created the theory of potential as we now have it. His work was neglected till 1846, and before that time most of its important theorems had been re-discovered by Thomson, Gauss, and others. Thomson brought Green's essay before the world, and employed the principle in solving a large number of difficult problems. The mutual potential energy of two repelling bodies in any relative position is the amount of work obtainable from their mutual repulsion by allowing them to separate to an infinite distance asunder. The potential at any point, due to any attracting or repelling body, or distribution of matter (quantities of electricity, magnetism, &c., enter into formulæ like quantities of ordinary matter), is the mutual potential energy between it and a unit of matter placed at that point. It is convenient to change the sign for attractions, so that the gravitation potential at any point, due to any mass, is the quantity of work required to remove unit of matter from that point to an infinite distance. The importance of this function in electricity is now acknowledged to be too great for it to be ignored by even unmathematical physicists, and we shall give a few necessary definitions and explanations. The 'potential' at any point in the neighbourhood of or within an electrified body is the quantity of work that would be required to bring a unit of positive electricity from an infinite distance to that point, if the given distribution of electricity remain unaltered. The 'difference of potential' between two points is therefore the quantity of work required to move a unit of electricity from one point to the other. This difference of potential between two points has also been called the 'electromotive force' between them; it has been described more vaguely as that which tends to produce a transference of electricity from one point to the other. (See OHM'S LAW.) Contact, the motions of magnets and of currents of electricity, &c., create differences of potential, and give rise to the flow of electricity. There is, of course, a unit difference of potential (or there is an action of unit electromotive force) between two points, if a unit of work is spent in transferring a unit quantity of electricity from one point to the other. The 'potential of a point' is an expression in common use; it means the difference of potential (the electromotive force) between the point and the earth. A surface at every point of which the potential has the same value is called an 'equipotential surface.' At any point on such a surface the force which would act upon an electrified particle is normal to the surface; in fact all 'lines of force' (which see) cut such a surface normally. When a current is passing along a wire or other conductor the potential varies from point to point, and it is such that the difference of potential between A and B is to the difference of potential between C and D as the resistance between A and B is to the resistance between C and D. This is merely a deduction from Ohm's law; it is the principle of the Wheatstone's bridge. See Everett's Natural Philosophy, Thomson and Tait, Clerk Maxwell's Electricity.

POTENTIAL ENERGY, that part of the energy of a system of bodies which is due to their relative position, and which is equal to the work which would be done by the various forces acting on the system if the bodies were to yield to them. Helmholtz called this 'the sum of the tensions,' Thomson called it 'statical energy' (the term 'energy' was first used by Young, in a scientific sense, to denote power to do work); but Rankine's name, 'potential energy,' significant of the energy which the system has the power to acquire, but which it is not possessed of, is that which has been universally adopted. If a stone is at a certain height above the earth's surface the potential energy of the system consisting of the earth and stone, in virtue of the force of gravity, is the work which might be done by the falling of the stone to the surface of the earth. This work is quite definite in amount, the weight of the stone and its distance from the earth being known. See PRINCIPLE OF THE CONSERVATION OF ENERGY.

POTENTIAL MOOD, that mood of a verb which expresses an action, event, or circumstance as merely possible. In English this mood is formed by means of the auxiliary *may*. In Sanskrit there is an inflected mood bearing this name, and having the function stated.

POTENTILLA, a genus of plants of the natural order Rosaceæ, with a concave calyx four to five parted, four to five petals, numerous stamens, a lateral or nearly terminal style, and flowers white or yellow, seldom red. The principal species are:—1. *P. reptans*, or creeping cinquefoil, a common British plant, with large bright yellow flowers. It is sometimes used as a febrifuge.—2. *P. tormentilla*, which has astringent roots, frequently used for tanning in the Faroe Isles, and in the Orkneys and Hebrides. They also yield a red dye. In Killarney they are given to pigs.—3. *P. anserina*, whose leaves are greedily devoured by geese, and sometimes used as pot-herbs, and whose roots are used both by hogs and men. Two species are used in Siberia as substitutes for tea, and several of them make handsome garden plants.

POTENZA, a province in the Kingdom of Italy, in Naples, bounded on the north by Foggia, on the east by Bari and Lecce, on the south by the Gulf of Taranto and the province of Cosenza, and on the west by the Mediterranean and the province of Salerno. It corresponds pretty closely with the ancient Lucania, which, however, extended to the west coast throughout its whole length. The chief productions of the province are maize, hemp, wine, silk, cotton. Potenza forms the whole of the department (*compartimento territoriale*). Area of the province, 4122 square miles; pop. in 1881, 524,485.

POTENZA, a town in Italy, Naples, capital of the province of same name, on a hill of the Apennines 85 miles E.S.E. of Naples. It is near the site of the ancient Potentia, from which it has its name. It is walled, and on the whole very indifferently built, but contains a number of handsome buildings, among others a fine cathedral in the Doric style. Potenza is the see of a bishop, and possesses a civil and a criminal court, a seminary, and royal college. It has suffered much from earthquakes. The most disastrous of recent times was that of 1857. Pop. (1881), 17,978.

POTHIER, ROBERT JOSEPH, a celebrated French jurist, born at Orleans, January 9, 1699; died there March 2, 1772. His digest of the maxims and principles of the Roman law contained in Justinian's pandects under the title of Pandectæ Justinianæ in novum Ordinem digestæ, was more highly esteemed in foreign countries than at home. Of his profound knowledge of the *droit coutumier* we have a proof in his Introduction à la Coutume d'Orleans, and the commentary which accompanies it. His different treatises on various points of legal science are in the highest esteem. The first, which is a sort of foundation for the others, is his Traité des Obligations, which, as is also the case with the rest, displays a methodical mind, and is distinguished for clearness, profundity, and precision, and for its high tone of morality, which was in accordance with the character of his life. Pothier was appointed professor of French law at the University of Orleans, and appropriated the salary attached to his office for premiums to his most industrious pupils. A statue was erected to him in one of the principal public places of Orleans in 1859. The best of the older editions of his works (exclusive of the Pandects) is that of 1777–78 (three vols. 4to). Of this edition there have been numerous re-impressions in various forms. The latest is that of Buguet (Paris, ten vols. 8vo, 1845–48).

POTI, the ancient Phasis, a fortified town in the Russian government of Kutaïs in Transcaucasia, situated at the mouth of the Rion on the eastern coast of the Black Sea. Since the erection of extensive harbour works and the opening of a railway to Tiflis this town has become a place of no small importance in the trade with Persia. Pop. 3023.

POT METAL, a coarse metal formed by throwing lumps of copper into red-hot molten lead. Also, a kind of stained glass in which the colours are incorporated with the substance by being added while the glass is in a state of fusion.

POTOCKI, the name of an ancient Polish family, the cradle of which was the castle of Potok in the former woywodeship of Cracow, and which still has large possessions in Galicia and the Ukraine. The following are among the most distinguished members of the family:—

1. COUNT STANISLAW FELIX, the commander of the Polish artillery, acted an important part in the troubles of 1788. He adhered pertinaciously to the old constitution of Poland, and exerted his influence against the constitution of May 3, 1791. (See POLAND.) Potocki so far forgot his duty to his country as to form connections with Russia, and in May, 1792, joined with Rzewuski and Branicki in the declaration at Targowicz against the constitution. He then united himself with the Russian army, and was one of the leaders of the diet of Grodno, which abolished the constitution, and subscribed the act for the partition of the country. (See PONIATOWSKI.) He was thought to aspire to the crown, and received several important appointments from Catharine II. He died in 1803.

2. COUNT IGNACY, his cousin, born 1751, Grand-marshal of Lithuania, united with Malachowski, Kolontay, and other patriots in support of the constitution of May 3, 1791. He also procured the declaration of the king in favour of it, and in 1792 went to Berlin for the purpose of inducing the Prussian court to protect the Poles from Russia. When the Russian troops took possession of the country Potocki fled to Dresden, and was deprived of his estates. In 1794 he returned to Warsaw to engage in the attempt of Kosciusko, and was appointed general and member of the supreme national council. After the capture of Warsaw he remained in the city, trusting to the capitulation concluded with Suvarroff, but he was arrested in December, and confined as a state prisoner in Russia until he was released by Paul in 1796. In 1806 he again engaged in public affairs, and exerted himself to effect the abolition of serfdom, and to promote the progress of education among the people. He died in 1809.

3. COUNT STANISLAW KOSTKA, brother of the pre-

ceding, born in 1757; died in 1821. He was always faithful to the cause of his unfortunate country. He distinguished himself greatly by his eloquence in the various diets which were held between 1788 and 1792. When the king acceded to the Confederation of Targowicz, and by that false step consummated the ruin of Poland, Count Potocki retired into Austria; but he was arrested there and imprisoned in a fortress. On being restored to liberty, there being no hope of breaking the chains of his countrymen, he retired to his estate, and devoted himself to the sciences and arts. He continued to live in retirement till the creation of the Grand-duchy of Warsaw in 1807, when he returned to his native country, and as president of the council of education applied himself unremittingly to the promotion of intellectual culture among his fellow-countrymen. When Napoleon gave out that he meditated the restoration of the ancient kingdom of Poland, Potocki's talent and influence were called into action by him; and the Abbé de Pradt pays to the count a warm tribute of praise on this occasion. In 1815 Count Potocki was appointed minister for ecclesiastical affairs and public instruction, and was afterwards chosen president of the senate. He was the author of a work on eloquence, and of a Polish translation of Winckelmann's work on ancient art.

4. Count Jan, one of the most distinguished of Slavonic historians, born at Pikow in the Ukraine in 1761; died in Poland in 1815. At an early age he formed the resolution of clearing up the obscurity that rested on Slavonic history, and prepared himself for carrying out this resolution by a course of linguistic studies, and by travelling over the lands occupied by Slavonic nations. He also travelled extensively in other parts of Europe and in Egypt, and even visited China. His most remarkable works are: Voyage en Turquie et en Égypte fait en 1784 (Warsaw, 1788); Essai sur l'histoire universelle et recherches sur la Sarmatie (Warsaw, five vols. 1788); Histoire primitive des peuples de la Russie (St. Petersburg, 1802); Fragments historiques et géographiques sur la Scythie, la Sarmatie, et les Slaves (Brunswick, four vols. 1796); Chroniques, mémoires et recherches pour servir à l'histoire de tous les peuples slaves (Warsaw, 1793); Voyage de Basse-Saxe, with engravings on copper containing the antiquities of Prillwitz (Hamburg, 1795); Histoire des gouvernements de Volhynie, de Podolie, et de Cherson (St. Petersburg, 1804–5). All these works are particularly valuable as collections of materials. His other works are all, like those cited, written in French. A life of Jan Potocki was published in Polish at Cracow in 1849.

POTOMAC, a river of North America, which rises in the Alleghany Mountains, and forms through its whole course the boundary between Maryland and Virginia, West and East. It passes Shepherdstown, Georgetown, Washington, Alexandria, and other places, and flows into Chesapeake Bay, between Point Look-out and Smith's Point. It is nearly 10 miles wide at its mouth and 1¼ at Alexandria, 290 miles from the ocean. The termination of the tide-water is above 300 miles from the sea, and the river is navigable for the largest ships through nearly that distance. Its junction with the Shenandoah at Harper's Ferry is remarkably picturesque. The river is 7 fathoms deep at its mouth, 5 at St. George's Island, 3 at Swan's Point, and thence to Alexandria. Above Washington there are several falls which obstruct the navigation. The total length of the river is 550 miles.

POTOSI, a city of Bolivia, in the province of the same name, lat. 19° 36′ s.; lon. 65° 24′ w. It was founded in 1547; the royal mint was established in 1562, and the population increased so rapidly that in 1611 it amounted to 150,000, many of whom were doubtless *mitayos* or Indians dragged thither by the system of forced labour called *mita*. The present population is only about 11,000. The mountain of Potosi is 16,037 feet high; and the city stands on a plain more than 13,000 feet above the sea, at which elevation the atmosphere is so rare as to cause extreme difficulty in breathing even with natives. The famous mines here were discovered by Diego Hualca, an Indian peasant, when pursuing wild goats. Arriving at a steep place he laid hold of a small shrub to prevent himself from falling, but the shrub being unable to support his weight was torn up by the roots, and disclosed to the hunter a rich mass of silver, lumps of which adhered to the earth that came away with the plant. Not long afterwards the discovery was made known, and the first mine was opened in 1545. From the time of the first discovery to 1803 these mines supplied 1,095,500,000 piastres, or £237,358,334 sterling, which paid the royal duties; and this only includes silver. If the gold and smuggled metals were included the amount would be much greater. The number of mines worked was formerly 300; in 1803 only ninety-seven. The mines are still worked, although their yield is very much less than it formerly was. They are now surpassed in productiveness by those of Cerro de Pasco in Peru. The banks of Potosi and Oruro have the exclusive privilege of buying the gold and silver obtained from them.

POT-POURRI (French) signifies the same as *olla podrida* (which see). It also signifies a vessel containing flowers or plants, and more generally any sort of medley.

POTSDAM, a town in Prussia, capital of the government of the same name, and the second royal residence of the kingdom, 17 miles south-west of Berlin, on the Havel, which is here crossed by a bridge 600 feet in length, and expands into a lake, with finely-wooded sloping banks. It consists of the Altstadt or Old Town, of an island formed on the south and south-west by the Havel and the north and west by a canal, and of the Neustadt or New Town, including Kietz, Friedrichstadt, Dutch Revier, and several suburbs. The different parts communicate with each other by bridges, and the whole forms one of the handsomest and most regularly built towns in Germany. Of the squares the most deserving of notice are the Old Market, with an obelisk of white and red marble 75 feet high and busts of the great elector and the first three kings of Prussia, the Wilhelmsplatz and the Lustgarten, laid out in beautiful walks and adorned with pavilions, statues, and fountains. The principal edifices are the Garrison Church, containing the tombs of William I. and Frederick the Great; the Nikolai Church, the French Church, built after the model of the Pantheon at Rome; the town-house; and the royal palace. Educational and benevolent institutions are numerous. The manufactures include all the ordinary tissues of wool, linen, cotton, and silk, leather and lacquerware, machines, earthenware, chemical products, wax-cloth, chocolate, vinegar, tobacco, &c. There is also a government manufactory of arms. Potsdam is the see of a bishop, has a provincial, high, and numerous other courts and offices, and several literary and other societies. Immediately to the west, outside the Brandenburg Gate (a triumphal arch in the style of Trajan's), commence the gardens of the Palace of Sans Souci, laid out, under the direction of Frederick the Great, in stiff French formal taste, with alleys, cut hedges, statues, basins, &c. The palace itself stands at the extremity of a broad avenue, crowning the summit of a succession of terraces; it has a fine colonnade,

but is a low building, by no means handsome, and only deserving of notice from the interesting associations connected with it. In the same neighbourhood is the New Palace, a vast brick building containing 200 apartments, and exhibiting much gaudy magnificence, erected by Frederick at the end of the Seven Years' war, in a spirit of bravado, to show that his revenues were not exhausted. There is a third palace in the environs of the town called the Marble Palace, or the Palace of the Holy Lake. Potsdam was an unimportant place till the great elector selected it as a place of residence and built the royal palace in the town (1660–73). Improvements have been made in it by nearly all the kings of Prussia. The most distinguished native of Potsdam is the celebrated statesman and philologist, Karl Wilhelm von Humboldt. Pop. in 1880, 48,447.

POTSDAM, a town in the United States, in the state of New York, county of St. Lawrence, 11 miles E.N.E. of Canton and 16 miles from the river St. Lawrence. It has several saw-mills employed in preparing lumber for the New York and Boston markets, numerous foundries, machine-shops, manufactories of furniture and agricultural implements, &c. Pop. of the township, 7774.

POTSTONE (*Lapis ollaris*), a species of talc containing an admixture of chlorite. Its colour is green of various shades; it is greasy and soft, but becomes hard on being exposed to the air. It derives the name of potstone from its capability of being made into vases, &c., by turning—a purpose to which it is often applied. It was well known to the ancients, who obtained it from quarries in the Island of Siphnos (now Siphanto), one of the Cyclades, and in Upper Egypt. It is now quarried in the Valais in Switzerland, in Norway, Sweden, Greenland, and the neighbourhood of Hudson's Bay.

POTTER, JOHN, primate of all England, born in 1674, was the son of a linen draper of Wakefield, in Yorkshire, in the grammar-school of which town he received the rudiments of a classical education. He then became a member of University College, Oxford, and in 1694 fellow of Lincoln College. In 1697 he printed an edition of Lycophron. Soon after (1697–99) appeared his Archæologia Græca, or the Antiquities of Greece, in two vols. 8vo, which has gone through many editions, and was long indispensable to the classical student. In 1706 he became chaplain to Queen Anne, on which occasion he graduated as Doctor in Divinity. In 1708 he was appointed regius professor of divinity at Oxford, in 1715 was raised to the see of Oxford, and in 1737 was appointed Archbishop of Canterbury. He died in 1747. His works, besides those enumerated, are A Discourse on Church Government (1707), an edition of Clemens Alexandrinus (1714), and theological works, printed together, in three vols. 8vo (Oxford, 1753).

POTTER, PAUL, a painter of animals, born at Enkhuisen in Holland in 1625, was the son of Peter Potter, a painter, from whom he received his first instruction, but to whom he himself was greatly superior. As early as his fifteenth year he had executed a work which was universally admired; and after he settled at the Hague he was unable to satisfy the demand for his works. His department was the painting of animals and landscapes, but he was more particularly successful in the former; the latter were designed merely to afford an opportunity for exhibiting animals in different attitudes and circumstances. His colouring is uncommonly brilliant, and the separate parts are most delicately executed, yet without any appearance of stiffness or mannerism. His pieces were generally of a small size; but there is one in the museum of the Hague, which originally belonged to the Prince of Orange, representing a man and cattle, with a bull in the foreground as large as life. It is well known as Paul Potter's Bull. His walks were always occupied in study; whatever struck his fancy he immediately sketched. He died in 1654, at the age of twenty-nine years, at Amsterdam, where he had been residing two years. His engravings are not less esteemed than his paintings. His cabinet pieces command a very high price.

POTTER'S CLAY. See CLAY.

POTTERY. The art of forming vessels or utensils of any sort of clay, kneaded with water and hardened in the fire, is of high antiquity, and we find mention of earthenware in the Mosaic writings. The Greeks at an early period had potteries at Samos, Athens, and Corinth. Demaratus, father of Tarquinius Priscus, is said to have instructed the Etruscans and Romans in this art, of which the Etruscan vases show the great perfection. (See ETRURIA and VASE.) Glazed earthenware was long supposed to be of no older date than the ninth century of our era, and to have first originated with the Arabs in Spain; but the discovery of glazed bricks in the ruins of Babylon, of enamelled tiles and glazed coffins in other ancient cities, proved that this is not the case. The Arabs, however, are entitled to the credit of having introduced the manufacture into modern Europe. The Italians seem first to have become acquainted with this kind of ware, as it was manufactured in the Island of Majorca, and hence they gave it the name of *majolica*. The art of making it was learned by them in the fifteenth century, when they set up their first manufactory at Faenza. In Italy the art was improved, and a new kind of glaze was invented, probably by Luca della Robbia. As the Italians had become acquainted with the glazed ware in Majorca, and hence given it the name of majolica, so the French derived their first knowledge of it from the Italian manufactory at Faenza, and on that account gave it the name of *faïence*. About the middle of the sixteenth century the manufactory of Bernard Palissy at Saintes in France became famous on account of the beautiful glaze and rich ornaments by which its products were distinguished. A little later the Dutch began to manufacture at Delft the more solid but less beautiful ware that takes its name from that town. The principal improver of the potter's art in this country was Josiah Wedgwood in the last century. A variety of stoneware takes its name from him. Porcelain or chinaware first became known in Europe about the end of the sixteenth century through the Dutch, who brought it from the East. For further particulars regarding the history of pottery see FAIENCE and CHINAWARE.

Though the various kinds of pottery and porcelain differ from each other in the details of their manufacture, yet there are certain general principles and processes which are common to them all. The first operations are connected with the preparation of the potter's paste, which consists of two different ingredients, an earthy substance, which is the clay proper; and a silicious substance, which is necessary to increase the firmness of the ware, and render it less liable to shrink and crack on exposure to heat. Each of these ingredients is first prepared separately, after which the two are incorporated together and undergo some further processes before the compound material is ready for the potter. The earthy substance or clay is first thrown into a cylindrical or conical vessel, in which revolves an upright shaft armed with a number of knives so arranged that the flat sides of their blades are in the line of a spiral curve. There are also fixed knives on the sides of the cylinder, arranged in the same way as those on the revolving shaft, but with their edges turned in the opposite

direction, that is, upwards. The result of the action of this machine is to bring the clay to an extreme degree of comminution, while at the same time the spiral movement of the knives, operating like a screw, forces the clay downwards till it makes its escape by an aperture at the bottom of the cylinder. It is then conveyed to a vat, where it is mixed with water and well stirred till it is reduced to a uniform pap. The agitator consists of a revolving vertical shaft, from which proceed at right angles two or four vertical series of spokes, the extremities of which are joined by vertical bars. When the mixture has been churned by this machine, called a *blunger*, till it has acquired something like the consistence of cream, it is run off through a set of wire, gauze, and silk sieves into cisterns, where it is diluted with water to a standard density. The other ingredient of the potter's material is usually ground flints, or flint-powder, as it is called. The processes by which the flint nodules are reduced to powder are the following:—They are first washed, then heated red-hot, and thrown into water to make them brittle and destroy their translucency. They are next pounded in a stamping-mill until they are reduced to a coarse powder, which is brought to the requisite degree of fineness by grinding in a mill between masses of chert. This fine powder is subsequently treated much in the same way as the clay, so that at the end of the separate treatment there are two liquors in separate sets of cisterns. These liquors are now mixed in such measure that the dry flint-powder bears to the clay the proportion of one-sixth or one-fifth, or even more, according to the quality of the clay and the practice of the manufacturer. The mixture is then run into long shallow troughs called *slip-kilns*, underneath which is an arrangement of flues intended to promote evaporation. There remains after evaporation a uniform inelastic mass, which is cut into cubical lumps, and transferred in this form to a damp cellar, where the lumps are piled one above another, and allowed to remain for several months. During this time a process of fermentation or disintegration goes on, by which the paste becomes finer in grain and not so apt to crack in the baking. But even after this process the ingredients composing the paste are not thought to be intimately enough incorporated together nor sufficiently fine in texture until another operation has been undergone. This is called *slapping* or *wedging*, and is performed in this way:—A workman takes each lump in succession in both hands, and by a sudden twist breaks it across; then strikes the two halves together in a different direction, and dashes the mass down on a board. This he repeats more than a score of times, after which the paste is ready to be shaped into the vessels which it is intended to make. This final process of incorporation and comminution is sometimes performed not in the way described, but by a machine similar to that by which the clay is first operated on—that containing the arrangement of fixed and revolving knives. When this machine is used the clay is passed through it several times before the operation is regarded as complete. The same object is sometimes effected in yet other ways both in this country and abroad.

In making earthenware vessels, if they are of a circular form, the first operation after the paste has been made is turning, or what is technically called *throwing* them on the wheel. This is an apparatus resembling an ordinary turning-lathe, except that the surface of the chuck is horizontal instead of vertical. The chuck is in fact a revolving table, in the centre of which a piece of clay is placed, which the potter begins to shape with his hands. The rotary motion of the table gives the clay a circular form, and it is gradually wrought up to the intended shape. Fig. 1 shows the different stages of an earthenware vessel wrought on the wheel. It is then detached from the revolving table and dried, after which it is taken to a lathe and polished with a tool. It is at this stage of the manufacture that the handles and other appendages are fitted on, which is done by means of a thin paste called *slip*. The articles are now removed to a room, in which they are laid on shelves and dried more thoroughly at a temperature of 80° to 90° Fahr. When they have reached a stage which is called the *green* state they are again taken to a turning-lathe, on which they are more truly shaped, as well as smoothed and burnished. When the articles are not of a circular form, and accordingly cannot be thrown or turned, they are either pressed or cast in moulds. In the former case the paste used is of the same consistence as that used on the wheel, and the moulds into which they are pressed are made of Paris plaster. In the latter case moulds of the same sort are used, but they are always kept thoroughly dry, so as to have great absorbent power, and the clay mixture is poured into them in the condition of slip. By the absorption of the water in the parts next the mould a crust is gradually formed of the shape of the mould, and of greater or less thickness, according to the time that the liquid is allowed to remain. The moulds are then reversed, and the excess of liquid is allowed to run out. Pieces are always cast in this way in halves, which are afterwards carefully joined together. It is evident that this method is only suitable for hollow articles.

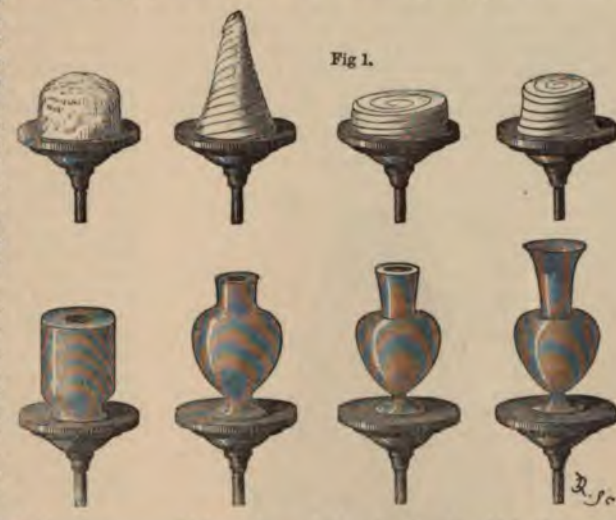


Fig 1.

When shaped and dried the articles in the hands of the potter are ready for the kiln, in which they are heated until they acquire a sufficient degree of hardness for use. The paste of which the earthenware is composed is thus converted into what is called *bisque* or *biscuit*. While undergoing this process of baking the articles are inclosed in larger vessels, called *saggers* or *seggars*, to protect them from the fire and smoke, and to distribute the heat more uni-

formly. The saggers are made of baked fire-clay, and are glazed internally. They have no lid, but are piled up in the kiln above one another, so that the bottom of one serves as a lid for the one below. The crevices between the different saggers are carefully closed with soft clay, and the top sagger in each pile or *bung* is covered with an unbaked one, attached in the same way. When a kiln is filled it may contain from forty-eight to fifty bungs, each made up of eighteen or nineteen saggers. Fig. 2 is a section of a potter's kiln of two stories. F F are the labora-

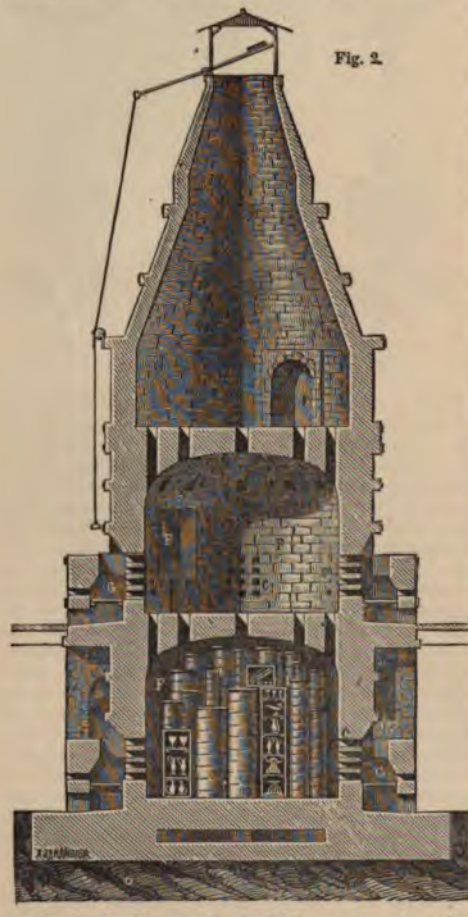


Fig. 2.

tories, in the lowermost of which are seen the piles or bungs of saggers, some of which are shown in section to discover the arrangement of the vessels inside; G G are the furnaces, C C C the flues, and P P doors. In order to indicate the progress of the baking a number of cups called *watches* are introduced into the kiln in an unbaked sagger, and are taken out by the attendant at fixed intervals as the baking goes on. According to the appearance of the watches the attendant increases or moderates the heat, and when the last watch is of the proper colour he gradually allows the fire to be lowered, and finally to go out. The whole firing lasts from forty to forty-two hours, during the first part of which period the kilns are heated to a comparatively moderate temperature, but during the latter part the heat is made much greater. After the kilns have been allowed to cool very slowly, the articles are taken out, and if they are not to be printed, that is to receive a coloured design, sometimes also when they are to be printed, are immersed in some glazing mixture called *glaze cream*, a vitrifiable composition, which, after the vessels have been a second time subjected to heat, is converted into a coating of glass, which renders the vessels impermeable to water. Three kinds of glaze are used in Staffordshire—one for common pipe-clay or cream-coloured ware, another for the finer pipe-clay ware, and a third for the ware which is to be ornamented by painting with the pencil. Various compositions are used in making these. In the glaze-kiln the vessels are arranged in the same way as in the biscuit kiln; only the saggers containing vessels covered with one kind of glaze are put in different parts of the kiln from those covered with another kind of glaze, since different kinds of glaze require different temperatures. The watches used in baking the glaze, to indicate the progress made, are pyrometric balls, coated with a very fusible lead enamel, and at the various stages these are compared in colour with the balls reserved from the corresponding stages of the previous baking. The firing lasts about fourteen hours, after which the temperature is reduced very slowly, slight additions of fuel being made to prevent a too rapid loss of heat.

The preceding processes are all that are necessary to complete a plain earthenware vessel, but very frequently the vessels are adorned with printed designs or paintings. Two methods are adopted in printing on earthenware—press-printing, which is done on the bisque; and bat-printing, done on the glaze. For the first method engravings are first executed on copper, in which the lines are cut pretty deep. The colouring matter, mixed with boiled oil, is then applied to the plate, which is meanwhile kept hot. The surface of the engraving is then rubbed clean, so as to leave the colouring matter only in the lines of the engraving, and in order that the colour may not spread and confuse the lines of the design, the oil, which serves as a vehicle for it, must be pretty thick and firm. When this is done a sheet of thin paper called pottery tissue, which is previously saturated in a solution of soap and water, is laid on the surface of the engraving, and this on being taken off carries with it the coloured design. When the superfluous parts of this sheet of paper have been cut off it is transferred to the bisque, and well rubbed, to make the impression sink into the ware. The article is then immersed in water, and the paper wiped off with a sponge. Lastly, the impression is freed from oil in the hardening kilns, and the vessel is glazed. For bat-printing an engraving is first made, as for press-printing, on copper, but in this case the lines are not made so deep. The lines of the engraving are filled with pure linseed-oil, which is taken off by sheets of a flexible preparation of glue, by means of which it is applied to the glazed surface of the ware. Finely-ground colour is then dusted on, and the vessel is ready to be fired in the enamel kiln.

All the numerous varieties of earthenware are made in the manner just described, with only slight modifications in the nature of the ingredients of their composition or the processes of manufacture. In warm countries a species of earthenware vessels are made which remain porous, and when filled with water promote evaporation through the body of the ware, and thus keep the water cool. In Spain these are called *alcarazzas*, probably from the town of Alcarazza, where they are largely made, and this name is the one by which they are known in this country. Their biscuit is said to contain a good deal of granular sea-salt, to the expulsion of which in the baking the porosity of the ware is largely due. Stoneware may be formed of the clays which are used for other vessels, with the addition of different sorts of sand, and

sometimes of cement. A greater degree of heat is applied than in the case of ordinary earthenware, and this has the effect of increasing the strength and solidity of the material, and when some fluxing substance is added, of producing that state of semi-fusion which is the distinguishing quality of stoneware. The glaze formerly used was invariably common salt. When the furnace had arrived at its greatest heat a quantity of this substance was thrown in, and the salt arising in vapour enveloped the hot ware, and by the combination of its alkali with the silicious particles on the surface of the ware, produced a perfect vitrification. Instead of this a mixture of Cornish stone, flint, and other ingredients has recently come into use. A kind of semi-vitrified ware, first made by Wedgwood, takes its name from him. It is made of two different kinds of pastes, both very plastic, so as to admit of all kinds of raised ornaments being wrought in them, and afterwards attached to the articles. This ware is incapable of taking on a superficial glaze; but by a process called *smearing*, which is simply baking at a high heat in saggers coated internally with a salt glaze, acquires a remarkable lustre. Naturally it is of a cream colour, but may have any other colour imparted to it by means of metallic oxides and ochres.

Porcelain or chinaware, which is the most beautiful and expensive of all earthenwares, is formed only from argillaceous minerals of extreme delicacy, united with silicious earths capable of communicating to them a certain degree of translucency by means of their vitrification. Porcelain is of two kinds, hard and tender. Both consist, like other earthenwares, of two parts—a paste which forms the biscuit, and a glaze. The biscuit of hard porcelain is composed of kaolin or china clay, a substance which in Great Britain is found in greatest abundance in Cornwall, and of decomposed felspar, to which is added at the manufactory of Sèvres a small proportion of Bougival chalk. The glaze consists of a felspar rock reduced to a very fine powder, and mixed with water, so as to form a milky liquid, into which the articles are dipped after undergoing a preliminary baking which is enough to make them perfectly dry and sufficiently solid to bear handling. Tender porcelain biscuit is mainly composed of a vitreous frit, that is, a composition made up of several ingredients differing at different manufactories, but always including a large proportion of silicious sand or ground flints, all baked in a furnace together till they are half-fused, and then reduced to the condition of powder. The glaze of tender porcelain is a specially prepared species of glass ground fine, and made into a liquid by mixing with water. To this frit is added a certain quantity of white marl or bone-ash. The processes employed in manufacturing porcelain wares of both kinds are very much the same as those used for other kinds of earthenware, but they all require much more delicacy and care. The biscuit paste even of hard porcelain has so little tenacity compared with that of the ordinary varieties of earthenware, that it cannot without difficulty be shaped on the wheel, and moulds are consequently more frequently used. Besides this the translucency of the ware when baked reveals the slightest flaw in the biscuit, so that even if the paste were equally tenacious with that of ordinary earthenware, much more skill would be required in the workmanship. Hence it happens that while a good workman at the Sèvres porcelain manufactory will make no more than from fifteen to twenty plates in a day, a workman in an English pottery, with the assistance of two boys, will make in the same time from 1000 to 1200. The paste of tender porcelain again is still less tenacious, so that the wheel cannot be used for it at all, and a little mucilage of gum or black soap must be added to it before it can be worked even in moulds. During the baking, too, it becomes so soft that every part of an article made of it must be supported. Each article in porcelain must be placed in the kiln in a separate sagger, and the saggers must be prepared with more care than those of ordinary earthenware, and of special materials. Tender porcelain receives two coats of the glaze, which is fused in the upper part of the kiln at the same time that the biscuit is baked in the lower.

Metallic oxides incorporated with some fusible flux, such as borax, flint, &c., are used for painting on porcelain. For gilding the gold is mixed with quicksilver and a flux, which give it the appearance of a black dust. The colours are mixed with essential oils and turpentine, and applied by means of a camel's-hair brush. Before being applied a ground-colour is dusted on the surface of the piece to be painted, which is previously covered with a uniform coat of boiled oil. If any parts are to be kept free of the ground-colour, they are protected by what is called a *stencil* (usually a mixture of rose-pink, sugar, and water). After the colour has been dusted on the vessel is heated, that the oil and colour may be hardened, and is then immersed in water, that the stencil may be washed off. It is then ready for the hands of the painter. When the painting is finished the vessels are baked in a peculiar kind of ovens called *muffles*, which are also used for fixing the printed figures on the glaze of stoneware. These ovens are of an oblong shape, and have semicircular roofs with openings in them to allow of the escape of the vaporous matters of the colours and the essential oils with which they are mixed. The articles are accordingly not inclosed in saggers, but when the muffles are charged, their mouths are covered with fire-tiles, the chinks round which are carefully closed with clay. By the operation of the furnace most of the colours employed in painting porcelain become quite different, and the change which takes place in them is usually through a series of tints, so that the proper tint will not be obtained unless the baking is stopped precisely at the proper time. The parts that have been brushed with the gilding mixture have the colour of gold after the baking, but must be burnished before they acquire the requisite lustre. While the colours on porcelain are being fixed in the muffles the articles, especially the larger ones, are apt to crack by a too sudden increase or lowering of the heat. This risk, added to that of running the colours by an error in the amount of the baking to be undergone, makes the execution of a painting in porcelain a very difficult matter; yet many of the paintings with which such articles are adorned are genuine works of art. In the International Exhibition at London in 1871 some specimens of porcelain were exhibited with designs etched on them by means of fluoric acid. The etching is done before glazing, and the lines may previously be filled in with gold or some colour in enamel. Sculptures are sometimes executed by casting in moulds in various kinds of porcelain, called statuary porcelain, Parian, Carrara, &c.

The name of hot-cast porcelain is given in America to a milk-white translucent kind of glass made by melting cryolite, silex, or pure sand and oxide of zinc together, and pouring the mixture into moulds.

The chief seat of the manufacture of all kinds of earthenware in Great Britain is Staffordshire, a district in the north-west of which, having an area of 16 square miles, goes by the name of 'The Potteries.' In 1882 the total value of earthen and china ware exported from the United Kingdom was £2,190,767.

POTTO (*Habrocebus*), a genus of Lemuroidea or Lower Monkeys, inhabiting Madagascar. This form is

of a light-brown colour, and averages about 14 inches in length. The tail is comparatively short. The native name for the Potto is 'Ampongne.' (See LEMUR, QUADRUMANA.) Potto is also a name for the *Cercoleptes* or kinkajou (which see).

POTTSVILLE, a town in the United States, in Schuylkill county, Pennsylvania, 93 miles north-west of Philadelphia in the centre of the great anthracite coal-field, at the termination of the Schuylkill Canal, and of the Philadelphia and Reading and the Schuylkill Valley Railways. It occupies a very picturesque site immediately above the gorge where the Schuylkill breaks through Sharp Mountain, and though of modern origin, having sprung into existence in consequence of the discovery of its valuable minerals, is now a well-built, stirring place. The manufacturing establishments include blast furnaces, forges, foundries, rolling mills, steam-engine and machine factories. The coal product of Schuylkill county for 1883 was 7,603,987 tons. The Pottsville Collieries have two vertical shafts 1640 feet deep—the deepest shafts in America. Pop. 13,384.

POTWALLERS, or POTWALLOPERS (pot-boilers), persons who, in certain English boroughs, such as Old Sarum, before the Reform Act of 1832, qualified as voters in parliamentary elections by cooking their own food in the open air within the bounds of the borough for which they voted.

POTY, POTI, or POTHI, a fort in Russia, Trans-Caucasia, in the government of Kutais, near the mouth of the Rion, on the east shore of the Black Sea, 55 miles W.S.W. of the town of Kutais. It is in the form of an oblong, flanked by large towers, and though the harbour is both insecure and too shallow to admit large vessels, carries on a considerable trade, exporting wine, honey, wax, silk, skins, &c. The steamers of the Commerce and Navigation Company of Southern Russia touch here once a fortnight. Pop. 1309.

POUDRETTE, the name given to a powdery manure obtained from ordure. The matter is put into the first of a series of large shallow tanks on different levels, the first being the highest. After being allowed to remain in this first tank long enough for the more solid and heavy parts to sink to the bottom, the more liquid portions are run off into the second, where after a certain period of repose another deposit is formed. This is continued until the matter reaches the last tank, from which the liquid, now almost completely deprived of solid particles, is permitted to run off into a channel, by which it is conveyed to some brook or river. The solid deposits that remain are then withdrawn and transferred to prepared ground, where they remain till they become perfectly dry, which does not happen till after the lapse of some years. At the end of this time the substance is in a proper condition for use. It is pulverulent, of a brown colour, and almost inodorous. It contains on an average about 25 per cent. of water, and 25 per cent. of fixed salts. It is largely made in France, and is in demand in all quarters, being found particularly useful for gardens. Its efficacy, weight for weight, is five times that of cow dung. In preparing the powder there is a very considerable waste of material, and different expedients have been devised for securing the efficacy without incurring the waste. One of these is the conversion of the material into what is called animal black (*noir animalisé*). In this case the matter on its arrival at the place of manufacture is mixed with an equal quantity of carbonized earth, which allows a greater quantity of liquid constituents to be retained. In the process of drying further quantities of ordure are added, till the earthy portion is only one-fourth of the whole. By this process two or three months suffice for drying.

POUGHKEEPSIE, a city in the state of New York, United States, situated on the east bank of the Hudson River, 75 miles north of New York city. It is built on a plateau about 200 feet above the river, and the slope leading thereto is laid out with some regularity, has many shade trees, and is very attractive in appearance. The eastern and western extremes of the city are connected by an efficient tramway system. It is known as the "City of Schools," and is noted for its institutions of learning. Vassar College, the first established and largest college for women in the world, is located here, also Eastman Business College, two military schools, and several seminaries for both sexes. The principal manufactures are of mowing machines, shoes, glass, pottery, iron, and dye-stuffs. Poughkeepsie is connected by railroad with New York, Albany, and the eastern states. It was settled by the Dutch at the close of the seventeenth century; the first substantial building was erected about 1705. The place was temporarily occupied as the capital of the state shortly after the organization of the government, and was the seat of the Convention of 1788, at which the federal constitution was adopted. Pop. in 1880, 20,207.

POULPE. See OCTOPUS.

POULTICES. See CATAPLASMS.

POULTRY, a general name for all birds bred for the table, or kept for their eggs. The birds most commonly included under this designation are the fowl in the restricted sense of the term (see COCK and FOWL), the pea-fowl, the guinea-fowl, the turkey, goose, and duck. It is unnecessary here to go into details concerning these birds, as separate articles will be found on each of them. There is one remark, however, which we may now make as bearing on the qualifications of the most important occupant of the poultry-yard, the domestic fowl, that there is one great difference between the varieties of this bird, namely, that some are disposed by constitution to continue laying throughout the whole season without sitting; while others after having laid from twelve to fifteen eggs sit obstinately, and seem to take their chief pleasure in this function, and the consequent ones of nursing and rearing. The former varieties are obviously the best where there is a large demand for eggs; and the latter, where the principal demand is for fowls for the table. Of the nine varieties of the domestic fowl which are most commonly kept in England, six may be classed as fowls which sit, and three as fowls which do not sit, except rarely. The former are the Malay fowl, the Cochin China fowl, the Dorking and its sub-varieties, the Game fowl and its sub-varieties, the Lark-crested fowl, and the Bantam; and the latter, the Spanish fowl, and the Hamburg and Polish fowls, with their sub-varieties.

The accommodation given to the poultry stock in the farm-steading is usually indifferent in character, and limited in extent. But if poultry are to be kept at all, they should be kept so as to turn them to the best account. They should have a lofty spacious house, with a yard and shed attached. The house should be moderately warm, well lighted, and perfectly dry. Where the requisite degree of warmth cannot be otherwise obtained, it might be advantageous to heat the house by a system of flues or by heated air. There are in common practice two ways of fitting up the interior of the poultry-house. The one is to form boxes along the walls to serve as nests for the fowls; the other to have shelves along the walls merely, on which baskets to form the nests may be put. These boxes and the shelves may be formed of wood; but for the farm-steading they are better when constructed of smoothly polished flagstones or slates. The usual arrangement is to have for the larger fowls a row of boxes 2 feet high, 2 feet deep,

and 2 feet wide next to the floor, but raised above it by a step 6 inches in height; and on the top of these large boxes to have one, two, or three tiers of smaller boxes, generally 15 inches in width, height, and depth. The top of the lowest boxes, projecting 9 inches beyond the tier above, forms a gangway in front of the second row of nests; and gangways are formed for the others, either by making the horizontal divisions wider, or by adding a board carried by brackets. To prevent the straw from being drawn out of these box-nests, a batten 3 inches high and 2 inches thick, rounded on the upper edge, is laid along the front to form a step. It is not fixed permanently, as it has to be removed to admit of the nests being washed out. When shelves merely are adopted they are placed from 18 inches to 2 feet apart. It is a decided improvement on this plan to place the nests not close to the wall, but at such a distance from it as to leave a passage between them and the wall. The side of the nests next the passage is then formed of lattice-work or wire-netting, made to open like a door. This arrangement, besides tending to keep the nests sweet, and admitting of their being more easily cleansed, allows the fowls to be set and the eggs to be withdrawn without going into the house.

The floor of the poultry-house should be formed of smooth flags or slates, with perfectly close joints. It should either sink towards the centre, in which case there should be an eye there communicating with the drain; or rise from all sides to the centre, in which case there should be a smoothly cut water channel round the walls, but about a foot from them. This last form admits of readier cleansing. The front of the step leading to the first row of boxes should be of the same smooth flag which forms the floor, and should not be vertical, but inclined. The skirting round the walls where there are no nests should be a continuation of this stone fronting, and inclined also. The walls should be smoothly plastered flush with the skirting. The best form of the roof is the hopper shape, with a ventilator at the apex. Proper roosts must be provided, either by building in rounded battens between wall and wall, or by erecting vertical posts or pillars in the centre of the apartment, and fixing to them frames for the roosts.

The house should be well lighted by one or more sliding windows, or by roof-lights. If roof-lights are adopted it is necessary to provide the means of admitting air near the floor of the apartment. Besides the door for the attendant, it is usual to make a small opening for the fowls, closed by a sliding shutter. This opening is generally made at the height of about 3 feet above the floor, and is reached by inclined gangways or ladders outside and inside. The yard for the poultry has only this peculiarity, that it is surrounded by a low wall, surmounted by a paling or lattice fence of wood or iron-wire.

If it can be avoided turkeys and geese had better not occupy at night the same house with hens and ducks, as they are apt to be cross and mischievous, especially to sitting birds. A low range of small fowl-houses, each just large enough to admit a parent bird and her brood, to be shut up separately at night, will be found extremely useful during the breeding season, and will prevent many deaths and so-called accidents among the young. A very small pond is sufficient for the thrifty rearing of both geese and ducks. It should be very carefully constructed with smooth closely-jointed stones, and should be provided with a supply pipe, an overflow, and a waste pipe, the last to admit of its being emptied and cleansed. It may be remarked in general that the grand requisite for success in the rearing of poultry is watchful attention, untiring industry, and a cheerful determination to make the most of the means at hand.

Fowls are subject to annoyances from many insects. They are often covered with lice, swarming with fleas and bugs, and the spider-fly (*Ornithomyia avicularia*) glides amongst the feathers. Cleanliness in their dwellings is the best security against such visitors. The gapes are occasioned by a worm called *Fasciola trachealis*, which, if not attended to, always proves fatal to chickens. It is, however, not difficult to remedy on its first appearance, either by administering Epsom salts mixed with the food, or in doses of two scruples; or if the barley and oats on which they are fed be mixed with urine instead of water, feeding them thus three or four times a day will be found equally efficacious. Another successful remedy is to take a pinion feather and strip it, excepting 1½ inch at the extremity, thrust it gently down the bird's throat, turning it round and drawing it out, until all the worms are extracted. Some gamekeepers are very expert in the operation, thus relieving pheasants and partridges hatched under hens from the gape-worm.

POUNCE (a corruption of *pumice*), gum sandarach or some other substance pounded and sifted very fine, to rub on paper in order to prevent ink from spreading on it. The best pounce for this purpose is ground cuttle-fish bone. Pounce is also the term applied to charcoal dust inclosed in a piece of muslin, or some other open stuff, to be passed over holes pricked in a work, in order to mark the lines or designs on paper, silk, &c., placed underneath, which are to be afterwards finished with a pen and ink, a needle, or the like; or to any other colouring matter prepared and used in a similar manner.

POUND, in English law, an inclosed place for keeping cattle which have strayed on another man's ground, until they are replevied or redeemed. A pound may be either overt or covert. A pound overt is one built by the lord of the manor for the use of himself and his tenants. A pound overt is thus a common pound, but a common pound may also belong to a parish or village, as well as a lordship. A pound covert is a close place for the exclusive use of the person on whose ground it lies. When cattle are put into an overt or common pound their owner is bound to feed them, and no notice need be given him of his having to do this; but when they are put into any other open place than a common pound the owner is not bound to feed them, unless he receive notice to do so. When they are put into a private or covert pound it falls to the person impounding them to feed them, but he is entitled to charge the owner of the cattle the cost of keeping them in settling with him for the amount of damages to be paid. An attempt to release from a pound cattle lawfully impounded is punishable, according to 6 and 7 Vict. cap. xxx., by a fine not exceeding £5, with costs. In Scotland, the seizing of stray cattle, and keeping them until damages are paid is called poinding of cattle. See POINDING.

POUND, an English weight of two different denominations, *avoirdupois* and *troy*. The pound avoirdupois contains 7000 grains, and is divided into 16 ounces; and the pound troy contains 5760 grains, and is divided into 12 ounces. In the old apothecaries' weight the pound troy was used, but in the revised weights and measures of the British pharmacopœia the pound avoirdupois is adopted. For the use of the pound avoirdupois in natural philosophy, see POUND AVOIRDUPOIS.—*Pound* is also the highest monetary denomination used in British accounts, being equal to 20 shillings. The name has originated from the fact that the pound in silver coins was equal to one pound weight of standard silver.

POUNDAGE, a sum paid for every pound sterling. Thus, there was formerly a subsidy of 12 pence in the pound paid under this name to the king on the value of all exports and imports. A poundage of 1*s.* is allowed a sheriff for a writ of *fieri facias* for all sums levied not exceeding £100, and 6*d.* for every sum of one pound over and above that amount. A penalty of £40 may be imposed if more is exacted. A poundage was formerly allowed also for writs of *capias ad satisfaciendum*, but it was abolished by 5 and 6 Vict. cap. xcviii. s. 3.

POUND AVOIRDUPOIS, the unit of mass commonly employed in England. It is the mass or quantity of matter (as indicated by the inertia of matter) of a certain piece of metal kept in the exchequer chambers. The use of the pound as a unit of mass, in natural philosophy, is gradually dying out in favour of the gramme (the mass of a cubic centimetre of water). The weight of a pound of matter of any kind at London, in vacuo, is commonly employed by engineers as a unit of force, and is called by Professors Thomson and Tait 'the gravitation unit of force.'

POUQUEVILLE, François Charles Hugues Laurent, well known by his work on Greece, was born in 1770 at Merlerault, in the department of Orne, studied medicine, accompanied the expedition to Egypt and Syria, and after a tour to Constantinople and Greece was sent by Napoleon as general to Ali Pasha at Janina, and in 1812 appointed consul-general at Patras. He was a member of the Academy of Inscriptions and the Medicinal Academy, and died at Paris in 1838. As early as 1801 he made himself known by a Dissertation on the Plague, as observed by him in Egypt and Syria (De Febre Adeno-Nervosa); then appeared his Voyage en Morée, à Constantinople et en Albanie, &c. (three vols. Paris, 1805), with maps; next his Voyage en Grèce, avec Cartes, Vues, et Figures (six vols. Paris, 1820–22; also printed in the Univers Pittoresque); and, lastly, La Grèce, Histoire et Description (Paris, 1835). Another work, which was published ten years before the last, and even gained more popularity than any of the preceding, was his Histoire de la Régéneration de la Grèce, 1740–1824 (four vols. Paris, 1824). It contains many gaps, and is far too favourable to the Greeks, but still presents valuable materials which may yet be turned to good account.

POURSUIVANT, or Pursuivant, in heraldry, the lowest order of officers at arms. The poursuivants are, properly, attendants on the heralds, when they marshal public ceremonies. There are now four poursuivants, the Rouge Croix, the Blue Mantle, the Rouge Dragon, and the Portcullis. The first two are of old but uncertain date, and the last two were instituted by Henry VII., the Rouge Dragon on the day before his coronation, and the Portcullis at a subsequent period. The Rouge Dragon was named from the ensign of his ancestor Cadwaladyr, and the Portcullis from one of his own badges.

POUSSIN, Gaspar, a very eminent landscape-painter, the son of a Frenchman, but born in Rome in 1613. His real name was Dughet; but he is commonly known either by the name given at the head of this article, or by that of Le Guaspre. His sister was the wife of Nicolas Poussin. The disposition which he early showed for painting caused him to be placed under his brother-in-law, whose surname he assumed; and being a lover of the country and its sports he devoted himself to rural sketches, and became one of the greatest masters of landscape upon record. He practised his art with great distinction in various parts of Italy, but chiefly in Rome, where he lived a life of celibacy, and freely expended his gains in hospitable attentions to his friends, as well as on the pleasures of the table and the chase. He worked with extreme celerity, although nothing can exceed the beauty of his scenery, and the precision of his perspective. He particularly excelled in the representation of land-storms, in which every tree seems agitated, and every leaf in motion. In his figures he was less happy, and they were frequently supplied by Nicolas. Gaspar Poussin died, according to D'Argenville, in 1675, and to others in 1663; but the former date is preferred. He engraved eight of his own landscapes.

POUSSIN, Nicolas, historical and landscape painter, was descended from a noble but poor family, and born at Andelys in Normandy in 1593 or 1594. He first studied in his native place, and then at Paris, under masters of little merit; but he made astonishing progress. He had already acquired considerable reputation when, in 1624, he went to Italy for the purpose of improving himself in his art. At Rome Marini the poet, with whom he had become acquainted and contracted a friendship at Paris, inspired him with a taste for the Italian poets, in whom Poussin found rich materials for the subjects of his paintings. After the death of Marini (1625) he was left without patronage, and obliged to sell his productions at very low prices. He continued, nevertheless, indefatigable in the study of geometry, perspective, architecture, anatomy, and other sciences necessary for a painter, and in the practice of his art. His conversation, his walks, his readings were also almost always connected with it. In his figures he copied antiques; he modelled statues and reliefs with great skill, and he might have become an excellent sculptor. In his landscapes he followed nature; they usually represent plains with magnificent ruins. All his works show much study; nothing is introduced without a purpose, or merely as an afterthought. For a considerable time he lived in rather poor circumstances, and was at last reduced to a state of destitution by an illness brought on by his excessive labours. He was now, however, taken care of by a Frenchman, Jacques Dughet (the father of Gaspar Poussin), who received him into his house, and tended him till his recovery. In 1630 Poussin married the daughter of his benefactor. About this time his affairs began to improve. He found liberal patrons in Cardinal Barberini (to whom he had been recommended by Marini, but who had been hitherto unable to show him any favour on account of his absence from Italy), and in the Cavaliere Cassiano del Pozzo, for whom he painted the celebrated Seven Sacraments. These works likewise gained him celebrity in France; and Cardinal Richelieu, at the suggestion of Desnoyers, invited him to Paris to paint the great gallery of the Louvre. Louis XIII. appointed him his first painter, with a pension of 3000 livres. Poussin arrived in Paris in 1640, and executed numerous works, particularly historical pieces from the Old Testament, and a repetition of his Seven Sacraments, but was much harassed by his enemies. The painter Jacques Fouquières had been employed to decorate the gallery with views of the principal cities of France, and the architect Mercier had overloaded it with ornament. Poussin found himself under the necessity of beginning his undertaking with the removal of their labours. He also had to contend with the whole school of Simon Vouet, who was protected by the queen; and his paintings were less justly appreciated by the French, who leaned to the brilliant and showy, than by the more correct taste of the Italians. An artist who loved quiet, and had been all his life devoted to his art, could not be contented in such a situation, and he soon determined to leave Paris. In September, 1642, while employed on cartoons of the Labours of Hercules for the gallery

of the Louvre, he returned to Rome, which he never again quitted. He died there in 1665. Although Louis XIV. allowed him to retain his post and pension, yet he never became rich; his disinterestedness made him neglect the opportunity of acquiring wealth; he laboured more for fame than for money. Full of veneration for the ancients, he aspired to the lofty ideal which he observed in them. His drawing is remarkably correct; his composition judicious, dignified, and noble. His invention was rich; his style grand and heroic. His expression approaches that of Raphael, and he has been called the Raphael of France. His merits were due to his own efforts. His only pupil was his brother-in-law Gaspar, who became distinguished as a landscape-painter. Poussin had studied the works of Titian, but his later productions are inferior in colouring to his earlier, since he paid less attention as he advanced in life to this branch of the art, and more to the design. Poussin has been censured for a too studied arrangement, and a too great propensity to episodes; too much uniformity in the attitudes, air, and expression of his figures; an excessive fulness in the drapery, and too small proportions in his figures—faults which may have been owing to his close imitation of the ancients. But notwithstanding these faults Poussin may be compared with the greatest Italian masters. Among his most celebrated works are the Seven Sacraments, the Deluge, the Death of Germanicus, the Capture of Jerusalem, the Plague of the Philistines, Rebecca, the Adulteress, the Infant Moses, and Moses bringing Water from the Rock, the Worship of the Golden Calf, John Baptizing in the Wilderness, &c., and many fine landscapes. Bellori has written his life in Italian. Château, Poilly, and Claudine Stella have engraved many of his works.

POWELL, BADEN, a distinguished theological writer, was the eldest son of Baden Powell, of Langton, Kent, and was born on the 22d of August, 1796. He gained high mathematical honours at Oxford, and in 1827 was elected Savilian professor of geometry in that university. He never held any living in the church, but delivered occasional discourses. As a theological writer he is noted for the boldness with which he conducts the investigation of religious truth, adopting views of Scriptural interpretation which many regard as in the highest degree heterodox and latitudinarian. His principal works are—The Connection of Natural and Divine Truth (1838); Essays on the Spirit of the Inductive Philosophy, the Unity of Worlds, and the Philosophy of Creation (1855); Christianity without Judaism (1857); and The Order of Nature considered with Reference to the Claims of Revelation (1859). He is also the author of the essay On the Study of the Evidences of Christianity in the well-known Essays and Reviews. He has likewise written several papers on the theory of light, a subject to which he paid considerable attention. He died in London on 11th June, 1860.

POWER, in law, is an authority which one man gives to another to do certain things which the agent would not be otherwise entitled to do; and it is sometimes a reservation which a person makes in a conveyance for himself to do some acts, as to make leases or the like; thus, *power of attorney*, an instrument or deed whereby a person is authorized to act for another, either generally or in a specific transaction. A power is given by will or deed.

POWER LOOMS are driven by water or steam, and are now universally introduced into cotton and woollen manufactories. See WEAVING.

POWERS, HIRAM, an American sculptor, the son of a farmer, and the eighth of a family of nine, was born at Woodstock, Vermont, 29th July, 1805. He received an elementary education at a free district school, and on the removal of the family to Ohio was employed successively in a hotel reading-room, a produce store, and as assistant to a clock-maker. Forming the acquaintance of a German sculptor he soon learned to produce plaster busts of considerable merit. He was subsequently appointed director of the waxwork department of the Western Museum of Cincinnati, an office which he held for seven years. In 1835 he resolved to depend for support upon his labours as a sculptor, and repaired to Washington, where he was for some time profitably employed in modelling busts of distinguished men. With the proceeds derived from these efforts, and the aid of Mr. N. Longworth of Cincinnati, he was enabled to carry out his long-cherished desire to visit Italy. In the following year he established himself at Florence, where, with the exception of occasional visits to Rome, he resided until his death, which took place 27th June, 1873. His statue of Eve, which excited the warm admiration of Thorwaldsen, was produced in 1838; next year was modelled the still more popular Greek Slave, of which six copies in marble, and innumerable casts, are in existence. Among his other works the most notable are—The Fisher Boy, of which three marble copies were taken; Proserpine, Il Penseroso, California, America (the last for Sydenham Crystal Palace); and statues of Washington for the state of Louisiana, of Calhoun for South Carolina, and of Webster for Boston; together with busts of Jackson, Adams, Everett, Van Buren, and other distinguished Americans.

POWERS OF EUROPE, GREAT, a term of modern diplomacy, by which are now meant Britain, France, Austria, Germany, Italy, and Russia.

POYNING'S LAW, or statute of Drogheda, an act of Parliament, passed in 1495, whereby all general statutes before then made in England were declared of force in Ireland. See IRELAND—History.

POZOBLANCO, a town in Spain, Andalusia, in the province of Cordova, and 36 miles north of the city of that name. It has regular and paved streets, an hospital for the sick, a foundling hospital, a chair of Latin, several primary schools, a town-house, a flesh-market, a church, and several hermitages. There are woollen, earthenware, and chocolate manufactories, dye-works, soap-works, flour-mills, and oil-mills; but the greatest portion of the inhabitants are employed in agriculture and as muleteers. Pop. 10,026.

POZZOLANA, or POZZUOLANA, is a kind of substance formed of volcanic ashes. When mixed with a small portion of lime it quickly hardens, and this induration takes place even under water. This singular property of becoming petrified under water renders it peculiarly valuable as a cement in the erection of moles and other buildings in maritime situations. It is much used in Italy as a substitute for mortar, and has received its name from Pozzuoli, the port from which it is shipped.

POZZUOLI, the ancient *Puteoli*, a town of Southern Italy, 6 miles W.S.W. of the city of Naples, on the north-eastern shore of the Bay of Baiæ (Golfo di Pozzuoli), the north-western portion of the Bay of Naples. The coast forms a natural harbour, which is well sheltered; and an active fishing is carried on. The town is the see of a bishop, has a civil court, and there are manufactories of soap. There are a cathedral, two parish churches, &c.; but Pozzuoli is chiefly interesting for its numerous memorials of classic ages. The cathedral stands on the site of a temple of Augustus, and in one of the lateral walls six Corinthian columns of the old temple are preserved. At the western extremity of the town a narrow street leads to the Serapeum or temple of Serapis, an Egyptian god invoked by the priests to sustain the healing virtues of the mineral waters of

the place. It consisted of a square court, inclosed by forty-eight massive marble and granite columns, and with forty-three small chambers adjoining. The portico rested on six Corinthian columns (three of which still remain). In the centre of the court stood a circular temple, surrounded by a peristyle of sixteen Corinthian pillars. The lower portions of the ruins are under water. The base portion of the central columns have been bored by shell-fish, which fact along with others have led some eminent geologists to maintain that there have been here striking changes in the level of the coast. On the eminence behind the town stands the ruined amphitheatre, resting on three series of arches which were surrounded by an external court. The two principal entrances were adorned with triple colonnades. About 25,000 spectators could have found accommodation. The arena, which was 358 feet long by 147 feet broad, could be laid under water by means of a conduit when naval combats were to be represented. The celebrated gladiator-combats got up by Nero during the stay of Tiridates, king of Armenia, took place here. The other objects of interest are the ruins of the temples of Neptune and of the Nymphs; and the Solfatara, a half-extinct volcano near the town, from the crater of which vapours and sulphureous gases ascend, and on the sides of which small brooks have their source, the saline waters of which are used as a remedy for cutaneous diseases. At a short distance inland, bounded by chestnut and vine-clad hills, lies the celebrated Lake Avernus. See AVERNUS.

Pozzuoli was founded by the Greeks of Cumæ about 520 B.C., and was called by them Dicæarchia. It obtained its Latin name Puteoli either from its numerous wells or from the stench arising from the mineral wells in the neighbourhood. It was indebted for its importance to its excellent harbour, which was protected by an extensive mole, to which Caligula attached a floating bridge extending as far as Baiæ, a distance of 2 miles. Extensive remains of the mole still exist. Puteoli was the chief emporium for the commerce with Alexandria and the greater part of Spain. Here St. Paul landed on his way to Rome. It was colonized by the Romans in 194 B.C., and again under Augustus, Nero, and Vespasian. It was taken and plundered by Alaric in 410 A.D., by Genseric in 455, and by Totila in 545. It was rebuilt by the Byzantine Greeks, but suffered severely from earthquakes and volcanic eruptions, and has never since attained its ancient importance. Pop. of the modern town, 11,751.

PRACHATITZ, a town in Bohemia, circle of Prachin, on the Ziwnybach, 22 miles W.N.W. of Budweis. It is walled, is an ancient place, with narrow, gloomy streets; has a fine church, a town-house of a venerable and majestic appearance, a court-house, superior German school, barracks, and hospital. The staple manufacture is brandy. Pop. (1880), 4359.

PRADES, a town in France, department of Pyrénées-Orientales, right bank of the Tet, in a rich and verdant valley, 24 miles W.S.W. of Perpignan. It has a large and handsome church, a court of first resort, a communal college, a secondary ecclesiastical school, and an hospital; manufactures of woollen cloth, moleskins, leather, and paper; and a trade in corn, fruit, wine, flax, hemp, horses, mules, cattle, fine wool, &c. Pop. 3134.

PRADIER, JAMES, a statuary, born at Geneva in 1792, went to Paris in 1809, and studied design under Meynier, and statuary in the studio of Lemot. In 1813 he gained the prize of the Academy for a bass-relief of Philoctetes and Ulysses. This work procured him admission into the French Academy at Rome. Here he developed his talents by studying the antique, and returned to Paris with two statues, one of a Bacchante and the other of a son of Niobe. In 1821 he went a second time to Rome, where he remained till 1823, and brought back a beautiful statue of Psyche, which he had made out of part of the shaft of an ancient marble pillar found at Veii. From this period he worked constantly at Paris, and produced a great number of larger and minor sculptures, including a Venus, a most lovely group of the Three Graces, a model of Jean Jacques Rousseau, after which the casting at Geneva has been made, and Cyparissus with his goat and a huntress. He was admitted to the Institute in 1827, and afterwards executed, among other works, a Prometheus, a Faun and Bacchante, a Phidias, the bass-reliefs on the pediment of the chamber of deputies, the allegorical figures of Lille and Strasburg in the Place de la Concorde at Paris, the Industry in front of the exchange, the Flora, which he himself regarded as one of his most successful works, the Twelve Colossal Victories on the monument of Napoleon in the Hotel des Invalides, the Atalanta in the exhibition of 1851, and the Sappho, which was exhibited in 1852. In the same year, while taking a walk near Paris, he was suddenly seized with illness, and expired. The execution of his works ranks him a sculptor of the first class, but his conception is by no means free from defects, and there is, according to the colder critics of England, a decided meretriciousness in his style. He has the merit of having formed several distinguished pupils.

PRADT, DOMINIQUE DUFOUR DE, once Archbishop of Mechlin, and a well-known political writer, born in 1759 at Allanches, in the old province of Auvergne, early adopted the ecclesiastical life, and at the outbreak of the revolution was grand-vicar to the Cardinal de la Rochefoucault, archbishop of Rouen. The clergy of Normandy sent him to the constituent assembly, in which he voted in the interests of the clerical and royalist parties. On the closing of the convention he fled to Hamburg, where, in 1798, he published anonymously the first and most famous of his writings, Antidote au Congrès de Rastadt, and soon after La Prusse et sa Neutralité, in which he censured the coalition of the European powers for making peace with France, urged a new war against the French Republic, and prophesied its overthrow. After the 18th Brumaire he returned to France and was presented by Duroc to the first consul, who was so pleased with his talents that he made him first almoner. On the emperor's coronation in 1804 he received a present of 50,000 francs, and was made a baron and Bishop of Poitiers, and in 1808 Archbishop of Mechlin and officer of the Legion of Honour, and was presented with a second present of 50,000 francs. In 1812 he was intrusted with an important mission to Warsaw, in which he failed, and was deprived of his office as almoner, and ordered to his diocese. On the approach of the allies to Paris he proceeded thither to take part in the negotiations as to its capitulation. The provisional government made him chancellor of the Legion of Honour. During the Hundred Days he lived on his estate in Auvergne. After Napoleon's banishment to St. Helena he showed himself again in Paris, and published his Histoire de l'Ambassade dans le Grand Duché de Varsovie, in which he gave full scope to his hatred of his former protector. About this time the King of the Netherlands purchased his right to the archbishopric for an annuity of 10,000 francs, and his office of grand-chancellor was bestowed by the Bourbons on Marshal Macdonald. Thus deprived of all his offices, and reduced to the simple Abbé de Pradt, after some fruitless attempts to gain influence with the Bourbons he abjured legitimacy, and began to write in defence of constitutional freedom and against the abuses of the clergy

—a new career, which procured him some degree of popular fame. He was twice prosecuted for the too free expression of his ideas, but on both occasions was acquitted. Among his other writings not already mentioned are his Parallèles de la Puissance Anglaise et Russe, Du Congrès de Vienne, Les Quatre Concordats, Le Congrès de Carlsbad, and Du Jesuitisme Ancien et Moderne. He died in 1844.

PRAED, WINTHROP MACKWORTH, a celebrated author and politician, was born in 1802. He was educated at Eton, where in 1820 he became one of the principal contributors to a magazine published there called The Etonian. From Eton he went to Trinity College, Cambridge, where in 1823 he obtained the chancellor's prize for an English poem entitled Australia, and the following year the same prize for another entitled Athens. On the publication of Knight's Quarterly Magazine he became one of the chief contributors to it, both in prose and verse, many of his poems displaying a rare degree of excellence. In 1829 Mr. Praed was called to the bar, and in 1830 and 1831 was returned for St. Germans to Parliament, where he took a prominent part in opposing the passing of the reform bill. He sat subsequently as member for Great Yarmouth, and afterwards for Aylesbury. He acted also for a short time as secretary to the board of control, and became ultimately recorder of Barnstaple and deputy high-steward for the University of Cambridge. In the midst of a promising career he was prematurely cut off in July, 1839. A collection of his poems, which are mostly of a light and elegant character, was published at New York in 1844; but a far more complete edition is that of London, 1864.

PRÆFECT, the title of various functionaries of ancient Rome. Of these the most important was the *præfectus urbi* or *urbis*, or warden of the city, originally called *custos urbis*. The name *præfectus urbi* does not seem to have been used till after the time of the decemvirs. During the kingly period and the early years of the republic the *custos urbis* exercised within the city all the powers of the chief of the state in his absence; he convoked the senate, held the comitia, and on any emergency might take such measures as he thought proper. When the office of *prætor urbanus* (see PRÆTOR) was instituted the wardenship of the city was swallowed up in it; but the conservative spirit of the Romans still induced them to appoint annually a *præfectus urbi* for the time during which the consuls were absent from the city to celebrate the Feriæ Latinæ. (See FESTIVAL.) This functionary had neither the power of convoking the senate nor the right of speaking in it, and the title became a nominal distinction conferred by the consul on young men of illustrious families. Under Augustus, however, the office ceased to be a sinecure. The *præfectus urbi* was a permanent magistrate whom the emperor invested with all the powers necessary to maintain peace and order in the city. He had under him a sort of police called *milites stationarii;* and the powers of the office were gradually so far extended that at last there was no appeal from his sentence except to the emperor, whereas the *præfectus urbi* was empowered to hear appeals from the sentence of any other city magistrates, and even from those of the governors of provinces. The *præfectus prætorio* was the officer who commanded the troops who guarded the emperor's person. (See PRÆTORIANS.) The office was first instituted by Augustus, and was at first only military, and had comparatively little influence attached to it; but under Tiberius it became of much greater importance, and the power of these præfects became only second to that of the emperors. From the time of Severus to that of Diocletian they had the superintendence of all the departments of the state—the palace, the army, the finances, and the law; they also had a court in which they decided cases. The office was not always confined to military officers, and was filled on several occasions by distinguished jurists. In addition to these functionaries there were the *præfectus aquarum*, who was charged with the regulation of the water supply of the city; the *præfectus ærarii*, who had charge of the public treasury; the *præfectus vigilum*, who commanded the night-watch; with some others of less importance.

PRÆMUNIRE, in English law, a name given to a kind of offence of the nature of a contempt against the king (or queen) and the government, and is so called from the opening words of the writ preparatory to the prosecution of the offence—*præmonere* or *præmunire facias A. B.* (Cause A. B. to be forewarned that he appear before us, &c.) The first statute of præmunire was during the reign of Edward I. to repress the Papal encroachments on the rights of the crown, and several subsequent statutes before the Reformation greatly extended the number of penal acts under this title, and by still later statutes acts of a very miscellaneous nature have been rendered liable to the penalties of præmunire, as knowingly and wilfully solemnizing, assisting, or being present at any marriage forbidden by the Royal Marriage Act; asserting by preaching, teaching, or advisedly speaking that any person other than according to the acts of settlement and union has any right to the throne, or that the sovereign and Parliament cannot make laws to limit the descent of the crown; to assert that both or either of the Houses of Parliament have or has a legislative authority without the sovereign; and so on. The punishment is forfeiture and imprisonment during the sovereign's pleasure. Many of the statutes are now repealed, and prosecutions upon præmunire are unheard of in our times; the last took place during the reign of Charles II.

PRÆNESTE. See PALESTRINA.

PRÆTOR, a title given originally by the ancient Romans to the consuls as leaders of the armies of the state. According to Livy the office was instituted in 366 B.C., when the consulship was divided between the patricians and plebeians, and it was given to the former as an indemnification; it was not held by a plebeian until 339. The prætor was a kind of third consul; he was called the colleague of the consuls, and was appointed in the comitia centuriata with the same auspices. In the absence of the consuls from Rome he exercised their functions in the city, the senate, and the comitia. He was a curule magistrate, and had the imperium, although subject to the consuls, and was attended by six lictors. Originally the prætor was a consul of the preceding year, and after the admission of plebeians to the office it was filled for some time alternately by the patrician and plebeian consul of the former year. In 246 B.C. another magistracy, that of *prætor peregrinus*, was instituted for the purpose of settling disputes between foreigners and between foreigners and citizens; and in distinction from him who filled this office the other functionary was termed *prætor urbanus*. After election the two prætors determined their offices by lot. The prætor urbanus was the first in position, and was specially spoken of as the prætor; he was the chief magistrate for the administration of justice, and could not remain more than ten days from Rome. To the edicts of the successive prætors the Roman law is said to owe in a great measure its development and improvement. So long as the power of Rome was confined to Italy there were only two prætors, but on the subjugation of Sicily and Sardinia, and their formation into provinces in 227, prætors were appointed for their government; and the same thing took place on the

conquest of Spain. Under Sulla the number of prætors was raised to eight; under Julius Cæsar the number rose gradually to sixteen. The number varied from about twelve to sixteen during the empire. Under the emperors their power was considerably reduced, but the office continued to exist to a late period.

PRÆTORIANS. In the times of the republic the *cohors prætoria* was a body of troops selected to guard the person of the commander (in old Latin, *prætor*) while in active service. But Augustus established a standing body-guard, consisting of three cohorts, called *prætorians*. This number was afterwards increased to nine, and a body of horse was finally added. In order to avoid the appearance of despotism Augustus stationed only three of these cohorts in the city and dispersed the remainder in adjacent towns. Tiberius, however, under pretence of introducing a stricter discipline among them, assembled them all in Rome, where a strongly fortified camp (*castra prætoria*, or *prætoriana*, or *prætorium*) was assigned them. Their number was increased by Vitellius to sixteen cohorts of 1000 men each. Their term of service was originally fixed at twelve years, but was afterwards extended to sixteen. They received double pay; the privates were considered equal in rank to the centurions of the regular army, and when they had served their time each received 20,000 sesterces (over £150). Under the later emperors, particularly from the time of Commodus, they often deposed and murdered the emperors, and raised their favourites, or even (as in the case of Didius Julianus) the highest bidder, to the throne of the Cæsars. Their commander (*præfectus prætorio*) became the most important officer in the state. (See PRÆFECT.) The prætorian guards were abolished by Constantine the Great in 312, their camp destroyed, and those who had not perished in the battle between that emperor and Maxentius were drafted into the regular legions.

PRAGMATIC SANCTION, a public and solemn decree relating to church affairs pronounced by the head of the legislature, distinguished from the simple rescript, which was a declaration of law in answer to a question propounded on behalf of an individual. In European history several important treaties are called pragmatic sanctions. 1. The ordinance of Charles VII. of France, drawn up at Bourges in 1438 conformably to the decrees of the Council of Basel, and on which rest the liberties of the Gallican Church. 2. The decree of the German Diet at Mainz in 1439, which sanctioned the same decrees as this council. Both limited the Papal power, but were altered by subsequent concordats. 3. The instrument by which the German emperor, Charles VI., being without male issue, endeavoured to secure the succession to his female descendants. It was in accordance with this instrument that he settled his dominions on his daughter Maria Theresa. He induced most of the European sovereigns to guarantee it; but Charles Albert, elector of Bavaria, the next heir to his dominions, refused; this caused the Austrian war of Succession after the death of the emperor in 1740. In the Peace of Füssen (1745) Bavaria acknowledged the pragmatic sanction. 4. Charles III. of Spain, when he ceded the throne of Naples to his third son and his successors in 1759, called the law of succession which he prepared for this branch of his family *sanctio pragmatica*.

PRAGUE (Bohemian, *Praha;* German, *Prag;* Latin, *Praga* or *Marobudum*), the capital of Bohemia, near the centre of the kingdom, on both sides of the Moldau, here crossed by seven bridges; 153 miles north-west of Vienna, with which and with Dresden it is connected by railway. Its site is a regular basin, cut in two by the river, from the banks of which the houses rise in succession, tier upon tier, till they are terminated and inclosed by hills of considerable height. When viewed from the old bridge no city in the empire surpasses Prague in the grandeur of its appearance. The bridge itself, of great historical interest, was erected between 1357 and 1507, consists of 16 arches, and is defended by a strong tower at each end; the buttresses are adorned with groups of statuary. The town was formerly inclosed by a wall and fosse, but these defences have been now demolished, and their sites occupied by private buildings, a public park, roads, &c. Prague consists of five quarters: the Altstadt, Josephstadt, and Neustadt on the right, and Kleinseite and Hradschin on the left bank. Outside the line of the old walls lie the suburbs Karolinenthal, Smichow, and the citadel Wyschehrad. The Altstadt and Josephstadt lie along the right bank towards the north. The streets of the Altstadt are narrow, but this being the principal seat of trade and business, and the special quarter occupied by the Jews, contains some of the best shops, besides numerous churches, ecclesiastical and educational establishments. The Neustadt incloses the Altstadt on the north-east, east, and south-east. Though newer than the other, it is still very ancient, having been built by the Emperor Charles IV. in 1348. It is not the scene of so much activity as the Altstadt, but its streets are wider. On the opposite side the Kleinseite forms the aristocratic quarter, the chosen abode of the Bohemian nobles, and the site of several remarkable palaces. The Hradschin, to the west and south of the Kleinseite, occupies the side of a steep hill, is of less extent, and contains far fewer houses than any of the other quarters, but perhaps surpasses them all in interest, in consequence of the public edifices which it contains. The principal public edifices are the old castle, or palace of the Bohemian kings, situated in the Hradschin; the cathedral, also in the Hradschin, a Gothic structure somewhat shapeless from having never been completed, and much dilapidated by the injuries which it sustained from the balls of Frederick the Great during the Seven Years' war; the Clementinum, the seat of the theological and philosophical faculties of the university and the Carolinum, devoted to the faculties of law and medicine; the Theinkirche, a Gothic church, historically interesting as the place where the Bohemian estates made George Podiebrad their king, and to some still more interesting as containing the grave of the celebrated astronomer Tycho Brahe, who spent his last years at Prague; the palace of Wallenstein, originally a structure of great magnificence, but now much dilapidated; the Alte Rathaus (old townhall), an irregular Gothic edifice of the fifteenth century, with a dungeon beneath in which the Emperor Wenzel IV. was confined for fifteen weeks; the chief synagogue of the Jews, probably as ancient in date as the end of the twelfth century; the military hospital, which is a large and magnificent edifice, originally erected by the Jesuits as a college; the theatre, the opera-house, the national museum, museum of natural history, picture gallery, the remarkable stone bridge of sixteen arches, erected by Charles IV. in 1357, and ornamented with twenty-eight statues, &c. The manufactures consist of gold and silver embroidery, silk, woollen, cotton, and linen goods, buttons, hats, leather, paper, soap, refined sugar, vinegar, liqueurs, refined salt, quills, sugar of lead, stearine and tallow candles, machines, musical and mathematical instruments, fire-arms, porcelain, fine and imitation jewelry. The trade is of great importance; Prague, owing to its central position, its situation on the

Moldau, which secures it a free communication with the Elbe, and to its facilities of transport by roads and railway, being the great entrepôt for all the traffic of the kingdom. It has also several important fairs, particularly one for wool, which lasts seven days, and during which a great amount of business is done; that of St. Winceslaus, the old patron saint of Bohemia; and that of St. John Nepomuk, though these two are rather religious festivals than fairs, and are more crowded with devotees than dealers.

Prague is one of the oldest towns in the kingdom, and is supposed to have been founded in 722 by the Duchess Libussa, but its history does not become important till the middle of the fourteenth century. In 1348 Charles IV. founded the university, the first which Germany possessed, and it soon acquired such celebrity through the teachings of such zealous rectors as Huss and Jerome that it was resorted to from all quarters of Europe, and is said to have had at one time over 20,000 students. In consequence, however, of quarrels between the Bohemian and foreign students, and the decision of the emperor in favour of the former, several thousand foreign teachers and students left the university, which led to the foundation of the Leipzig, Ingolstadt, Rostock, and Cracow Universities. It was attended in a recent year by 1900 students, who are instructed by 170 professors and other teachers, and has an extensive library, a fine observatory, anatomical and zoological museum, botanical garden, &c. In 1424 Prague was taken by the Hussites and almost destroyed, but after their submission to the emperor in 1433 the town was rebuilt. It suffered severely in the Thirty Years' war, and in 1620 a battle was fought at the White Mountain in the neighbourhood, in which the Elector-palatine Frederick V. was defeated by the Emperor Ferdinand II., and compelled to renounce his crown. In 1631 the city was captured by the Saxons, who were driven out a few months later by Wallenstein. In 1742 it was taken by the French and Bavarians, and two years later capitulated to Frederick the Great. After the Seven Years' war the city made rapid strides, and enjoyed peace and prosperity until 1848, when the Austrian government caused it to be bombarded for two days, owing to the marked democratic demonstrations excited by the meetings of the Slavonic Congress within its walls. During the Austro-Prussian war in 1866 the city was occupied by the Prussians, and here the treaty of peace was signed on the 23d August. Pop. 162,323, about three-fifths of whom are Czechs. The trade is almost entirely in the hands of Germans and Jews.

PRAIRIAL. See CALENDAR.

PRAIRIE (French, 'meadow'), the name given to the vast natural meadows or plains of the Mississippi valley, occupying the western part of Ohio, nearly the whole of the states of Indiana, Illinois, and Iowa, the southern part of Michigan, the northern part of Missouri, and portions of Kansas and Nebraska, in which, near the meridians of 97° and 100° w., they gradually pass into arid and desert plains. Throughout this immense territory the differences of level are sufficient to produce a steady flow of the rivers, but not so rapid as to obstruct their navigation, thus securing a system of easy intercommunication between all sections of the country, unsurpassed in importance by any similar system in the world. There is a great sameness in the features of the topography, the vegetable productions, the soil, and geological features. The surface is drained by streams which commence in almost imperceptible depressions of the high prairies, and flow in beds and valleys of gradually increasing depth, between vertical walls of limestone or sandstone through the horizontal strata of which the current has in past times made its channel. What are called bottom lands lie between the rocky bluffs and the stream, and attain in some places a width of 6 to 8 miles; but they are often wanting entirely, the bluffs on each side coming close up to the river banks. On the Upper Mississippi the bottom lands are generally well wooded, but along the state of Missouri they spread out into wide open plains. On the head-waters of the Illinois and the Wabash, and south and west of Lake Michigan the prairies are very level and smooth, and are termed flat. Elsewhere the surface is undulating and broken by the depressions of the streams, and are known as rolling prairies; some of the highest swells reach an elevation of 1500 feet above the sea level. The depressions where there are no streams are often 50 feet below the mean level, and in the bottom the soil is wet and marshy, forming almost impassable swales or sloughs. In these places the grass grows very rank and tall, but upon the upper and drier surface the natural growth is finer, and the sod dense and closely interwoven. A great variety of flowering plants, mostly various species of the helianthoid Compositæ, are interspersed among the grasses. Trees are sometimes met with in scattered groups called groves, or along the larger streams, or occasionally on low rocky ridges. The soil is remarkable for its finely comminuted condition; it is generally free from stones, though in some localities boulders are met with. In the swales, and in some of the bottom lands, the rich black vegetable mould is very deep, but on the upper prairies its depth is usually from 1 to 2 feet. The subsoil is almost invariably an argillaceous loam, more or less mixed in its lower portions with sand and occasional pebbles. Water is generally found in the sandy stratum 15 to 20 feet below the surface. The underlying rocks are soft, sedimentary strata, especially shales and impure limestones, which disintegrate readily and crumble into soil on exposure. Beneath the prairies, north-west of the Ohio, are extensive coal-fields, with deposits of iron, lead, &c. These vast plains, covering an area of 400,000 square miles, formerly fed vast herds of bisons (buffaloes), deer, wild turkeys, prairie hens, prairie dogs, squirrels, &c.; but these are vastly diminished in numbers now, or have altogether vanished. Remains of ancient mounds, fortifications, and cities show that they were, at some remote period, inhabited by more civilized races than those found by the European discoverers. Immense tracts are now cultivated, and produce large crops of wheat and maize with little outlay of labour on the part of the farmer. The same class of lands in British America are also called prairies, as those between the Rocky Mountains and Manitoba.

PRAIRIE DOG. See MARMOT.

PRÂKRIT, certain Hindu dialects, which acquired greater prominence as the older Sanskrit passed gradually out of use. These dialects first assumed a literary position in the Sanskrit dramas, where female characters, both high and low, are introduced as speaking Prâkrit, instead of the Sanskrit used by kings, noblemen, and priests. The modern tongues of India have sprung from the Prâkrit just as the Romance languages have sprung immediately from the old Italian dialects, and not from the literary Latin.

PRAM, CHRISTEN HENRIKSEN, an admired poet and miscellaneous writer, was born in 1746, at Lefta, in the Guldbrandsdalen, Norway. He studied at Copenhagen, and gained much by his intercourse with Ewald, Hessel, and others. In 1781, as a member of the agricultural and commercial college of Copenhagen, he undertook several tours, the results of which were published in the Commercial

Journal, founded by him in 1782. In 1815 he was discharged from his office with an insignificant pension, and in 1819 accepted the office of collector of customs on the island of St. Thomas, where in 1821 he fell a victim to the climate. His writings, which are numerous and embrace a great variety of subjects, both in political and natural science, display much industry and very extensive acquirements. Among his poetical productions are Heroide an Erich, which in 1779 gained the prize of the Society of Belles-lettres; Stärkodder, the most famous Norwegian heroic poem, in fifteen cantos, equally remarkable for its plan, contents, and form; his Satirical and Comic Tales, which, with a selection of his poems, were published at Copenhagen in 1824. Besides the Commercial Journal already mentioned, he founded another, called the Minerva, which was of essential service in diffusing information in the Scandinavian kingdoms.

PRASE, a dark leek-green variety of quartz, the colour of which is due to an admixture of hornblende.

PRATER, the most famous promenade of Vienna. See VIENNA.

PRATIQUE, a term used to signify a kind of limited quarantine, which the captain of a vessel is held to have performed when he has convinced the authorities of the port that his ship is free from infectious diseases.

PRATO, a town in Tuscany, 11 miles north-west of Florence, in a fertile plain, on the right bank of the Bisenzio. It is surrounded by ancient walls, has suburbs, and is a well-built, cheerful-looking place. It has a court of justice and several public offices; a beautiful cathedral, begun by Nicolo Pisano, and completed after his designs in 1450 with a façade, furnishing a beautiful specimen of Italian Gothic; several other churches, monasteries, nunneries, an old castle, an ancient prætorium (Palazzo Pretorio), now converted into a prison; a college or ecclesiastical seminary, called after its founder Cicognini, and adorned with a fine Italian front; a public library, a theatre, and several hospitals; and extensive manufactures of woollen, cotton, silk, and mixed goods, straw hats, paper, and articles in brass. Pop. Dec. 31, 1881, 13,410.

PRAWN (*Palæmon*), a genus of Crustaceans belonging to the highest order, Decapoda, of that class, and included in the section Macrura ('long-tailed') of the order. The outer pair of antennæ possess a large movable plate of oval or triangular shape. In the special family of the Prawns (*Palæmonidæ*) the beak or 'rostrum,' which projects in front of the carapace, is large, toothed, and of compressed shape. The feet are of stout conformation, and do not possess basal appendages. The Prawns themselves possess inner antennæ, terminating in three filamentous processes. The first and second pairs of legs are two-fingered or 'chelate,' the second pair being much larger than the first. The beak is specially long and compressed. The Common Prawn (*P. serratus*) is the most familiar species, and resembles the more familiar Shrimps in general appearance. Like the latter forms, prawns are found in great quantities on sandy coasts, whence they are fished by nets, and largely transported to the city fish-markets. When boiled the Prawns become of a pale pink colour, and are highly esteemed as table delicacies in this and in other shapes.

The Common Prawn attains an average length of from 3 to 5 inches. The tail is broad and flat, and its terminal plates are fringed with long hairs. The colour is light-gray spotted with purple. The carapace is more membranous than calcareous, and hence appears almost transparent when the animal is in the water. The Isle of Wight and Hampshire coasts form the chief sources of prawn supply to the London market. Various other species and varieties of the Prawn genus occur on the British coasts. Of these the *P. Squilla*, *P. Leachii*, and *P. varians* are familiar forms. Several tropical species attain a very large size. (Pl. LIV.–LV., fig. 17.)

PRAXITELES, one of the greatest sculptors of Greece. He was a citizen, if not a native, of Athens, and probably flourished about 364 B.C. He and his contemporary Scopas stand at the head of the later Attic school, so called in contradistinction to the earlier Attic school of Phidias. Without attempting to rival Phidias in his sublime impersonations of divine majesty, Praxiteles chose subjects which demanded a display of the human form, especially in the female figure. Pliny (Hist. Nat. lib. xxxvi. c. 4, 5) gives a list of his principal works. The finest is said to have been the Cnidian Aphrodite (Venus), whom he was the first to represent naked. According to tradition the celebrated courtesan Phryne (see PHRYNE) served as a model for it. Aphrodite was represented with a smiling countenance; the right hand held some drapery, which fell over a vase standing beside her, indicating that she had just left or was about to enter the bath. The statue was purchased by the Cnidians, who valued it so highly that they refused to part with it to King Nicomedes, who offered to pay off their heavy public debt if they complied. It was afterwards carried to Constantinople, where it perished by fire in the time of Justinian. The group of Niobe now in existence, which is also attributed to Scopas, seems to have been the production of different times. His two statues of Eros (Cupid) were also celebrated. One of them, which was placed in the temple of Eros at Thespia, and a statue of a satyr, which was called *periboëtos* (the far-famed), were considered by Praxiteles, according to Pausanias, as his finest works. An excellent copy of the latter was discovered in a villa of the Emperor Antoninus. Among his works were also statues of Apollo, Dionysos, Demeter, &c., in marble and in bronze, which served as models to succeeding artists.

PRAYER. Nothing proclaims more consistently and universally the connection between man and his Maker than the fact that in every time and place men have felt their dependence on a higher Being, and have sought his assistance in prayer. Even the heathen, who call upon a god that cannot save, show thereby their acknowledgment that they have necessities which they cannot satisfy, and that they believe that there is some One who can supply their needs. The Scriptures tacitly assume that prayer was offered to God from the beginning of the world; there were sacrifices from the time of Abel, and where there were sacrifices there must also have been sacrificial prayers. And although we do not read that men began to call upon the name of the Lord until after Seth was born, we are forbidden by all commentators to connect this statement with the origin of prayer. It is not, however, until the time of Abraham that prayer comes first distinctly into notice. His devout faith prompted him to build an altar wherever he remained, and to call upon God. He was doubtless a priest within his own family and household, and they participated in his services and obtained the benefit of his intercessions. As the altar appears to have been considered the special place for prayer in the patriarchal age, so was the tabernacle under the Mosaic covenant until the temple was built, which was called the house of prayer. From the time of the dedication of Solomon's temple the Jews appear to have gone there to pray, and to have turned their faces towards it if

they were prevented from going there; and this custom prevails among the Jews at the present time, as does the similar custom among the Mohammedans, who turn their faces towards the sacred Kaaba at Mecca. On examining the character of the prayers mentioned in the Old Testament we find that, with the exception of many of the Psalms, they were principally petitions for temporal objects. This is suited to the purposes for which the historical books of the Jewish Scripture were written, as the Mosaic covenant pledged God to confer temporal benefits on his people when they called upon him. We find also that a great number of them are intercessory; thus we have Abraham interceding for Lot, Moses for the people, Samuel for the people and for Saul, David for his nation, Elisha for the dead child, and so on. When we come to New Testament times we meet for the first time with synagogues established as places for the public worship of God, and for reading his word. The leaders in religion—the priests, scribes, and Pharisees—were no longer the faithful servants of God they once were. Christ went among the people doing good—healing the sick and bestowing forgiveness of sins; and the very fact that he exercised divine power caused the people to worship him and to beseech him in terms suited only to a divine being; his disciples pray him to save them from a storm from which no mortal power could deliver them. Thus the way was prepared for the important announcement made by our Lord towards the close of his ministry, that prayer should be offered to God in his name in order to insure an answer. Henceforward Jesus Christ became to the Christian what the temple was to the Jew: he was the embodiment of God, giving a definite object thereby for the faith of the suppliant to rest upon; he was also the propitiation for the sins of the world, and through his blood all that believe in him have access to the Father. The posture of the body in prayer is left undecided in Scripture; both standing and kneeling are mentioned, and Christ adopted both postures. So also is the question about forms of prayer left unsettled. By giving his disciples a form of prayer Christ implied that there are times when these are useful; but he never meant that the free utterance of the soul's wants should be entirely limited by formal services.

Against the testimony and experience of so many ages of mankind the objections of a small minority may be of little importance, yet they must not pass unnoticed. Such objections are generally resolvable into two propositions—1, that if God has foreordained all events no prayer can alter his will; and 2, that if God is omniscient it is useless to inform him of our wants. In answer to the first objection we may ask, Why has God put in us the strong instinct to pray to him if after all he intends to baulk it, and if, with all our faith and earnestness, we cannot change the order of his providence? Besides, we know so little about the way in which God acts that it is absurd for us to prescribe certain limitations to him in his modes of action. It is true that God changes not; it is also true that he hears prayer; each of these statements is inexplicable to us, and we cannot reconcile them. The most reasonable method of expressing the doctrine of prayer is to say that it is not a cause of God's actions, but a condition on which he acts. It is a distinct duty of the creature, looked for and waited for by the Creator before he proceeds to grant the request. He as readily foresees the prayer as the need of the thing prayed for, and the one is, generally speaking, the condition on which the other is granted. Prayer is not at all intended to supersede work, because praying and working are supplementary to each other. The second objection follows in the same groove. It is certain by God's own revelation of himself that he is omniscient; and it is also certain that he requires men to petition him as well as to offer him a pure service of adoration. How to reconcile these two opposite, or apparently opposite, facts, that a beneficent God knows our wants before we can name them, and is loving enough to satisfy them without being asked to do so, and yet requires us to put those wants before him in prayer, and to ask him to satisfy them, is a question that we cannot answer. They are facts that depend for their explanation on mysteries of God's nature which he has chosen to remain mysteries. But it is quite as certain that he has imposed the law of prayer as that it is that he has revealed himself to be omniscient; and while it would be very illogical to accept the revelation as true and to reject the law as false, it would also be folly to accept both as true and yet to refuse to act on the law because we cannot reconcile it with the revelation.

It has been suggested by some thinkers that the effect of prayer is purely subjective, and that its only result is to produce a stronger feeling of dependence in the suppliant. It is true that prayer does exercise a subjective influence, and this is doubtless a part of the work which it is intended to do, but it is not all. For why should God encourage us to pray for our daily bread if he does not intend to give us an answer to our prayers? Does not he that gives spiritual things give temporal things also? But the strongest objection to the theory may be drawn from the fact that intercessory prayer for the bodily and spiritual welfare of others is most strongly urged by example and precept in the Old and New Testament. It would be the merest mockery to pretend to pray for others if the only effect was to be in ourselves. It is dishonouring God to suppose him capable of conniving at this mockery by the exhortations of his holy word. It may be also added that the admission of such a subjective effect is also an admission, to no small extent, that prayer is not a mere fiction but a great reality; for no moral good could be expected to result, or would result, from the constant use of what, if it is not a reality, must be mere fetichism.

Prayer for the dead is a practice rejected by Protestants as having no scriptural warrant, but which prevails in the Roman Catholic, Greek, and other eastern Churches. The custom seems to have existed in most of the ancient religions, especially in those of India, China, and Egypt. The doctrine and practice came to the Christian Church through the Jews (2 Maccabees xii. 43, 45). Those who defend this usage maintain that the efficacy of prayer for the pardon of the sins of the departed is clearly intimated by Christ's teaching in the Gospels. He says that 'whosoever speaketh against the Holy Ghost it shall not be forgiven him, neither in this world nor in the world to come' (Matthew xii. 32), whence by only excluding from forgiveness in the world to come the sin against the Holy Ghost he may be understood to imply that less offences may be forgiven. The first of the Christian fathers who mentions prayer for the dead is Tertullian; but he speaks of the usage as well-known and long-established in the church; such prayers are frequently alluded to by St. John Chrysostom, Cyril of Jerusalem, and St. Augustine. In the burial service of the first Book of Common Prayer of the English Church some prayers for the dead appeared, but they were deleted from the second book, and are not found in the subsequent revisions.

PRE-ADAMITES (from the Latin *præ*, before), those supposed inhabitants of the earth prior to the creation of Adam. The legendary traditions of the

East speak of nations and empires existing before Adam's creation, and of a line of kings who ruled over them. In modern times the subject was taken up by Isaac de la Peyrère, who, in a work published in 1655, maintained that the Jews were the descendants of Adam, and the Gentiles those of a long anterior creation, founding his opinions on Romans v. 12–14. The term pre-Adamitic is sometimes applied to remains of human art discovered in positions which appear to geologists to be of an age beyond the limits which scriptural chronology assigns to the creation of Adam.

PREBEND, a yearly stipend paid from the funds of an ecclesiastical establishment, as of a cathedral or collegiate church. *Prebendary* is the person who has a prebend. A simple prebend has no more than the revenue which is assigned for its support; but if the prebend has a jurisdiction annexed, the prebendary is styled a *dignitary*. Prebendaries, as such, have no cure of souls; and therefore a prebend and a parochial benefice are not incompatible promotions. —The *prebendal stall* is the seat of the prebendary in the church, into which he is inducted by the dean and chapter.

PRECEDENCE, the order in which men and women follow each other in a state procession or on other public occasions. In England the order of precedence depends partly on the statutes 31 Henry VIII. cap. x., and 1 Will. and Mary, cap. i.; on the letters patent 9, 10, and 14 Jac. I.; and partly on ancient usage and established custom. Questions arising on matters of precedence depending on usage are hardly considered as definitely settled, and are in a great measure left to the discretion of the officers of arms. The following are the degrees of precedence as recognized by English law:—

Table of Precedence among Men.

The Sovereign.
The Prince of Wales.
Sons of the Sovereign.
Grandsons of the Sovereign.
Brothers of the Sovereign.
Uncles of the Sovereign.
The Sovereign's brothers' or sisters' sons.
The Archbishop of Canterbury, Primate of all England.
The Lord High Chancellor, or Lord Keeper, being a baron.
The Archbishop of York, Primate of England.
The present Archbishop of Armagh, by the Irish Church Act of 1869.
The Archbishop of Dublin.
The Lord High Treasurer.
The Lord President of the Privy Council. } Being of the degree of barons.
The Lord Privy Seal.
The Lord Great Chamberlain.
The Lord High Constable.
The Earl Marshal.
The Lord High Admiral.
The Lord Steward of Her Majesty's Household. } Above all peers of their degree; if dukes, above all dukes, &c.
The Lord Chamberlain of Her Majesty's Household.
Dukes.
Eldest sons of dukes of the royal blood.
Marquises.
Dukes' eldest sons.
Earls.
Younger sons of dukes of royal blood.
Marquises' eldest sons.
Dukes' younger sons.
Viscounts.
Earls' eldest sons.
Marquises' younger sons.
Bishops of London, Durham, and Winchester.
All other English bishops according to seniority of consecration.
The present Bishop of Meath, followed by the other Irish bishops existing in 1866, according to seniority of consecration.
Secretaries of State, being barons.
Barons.
The Speaker of the House of Commons.
Commissioners of the Great Seal.
Treasurer of the Queen's Household.
Comptroller of the Queen's Household.
Master of the Horse.
Vice-chamberlain of the Queen's Household.
Secretaries of State below the rank of baron.
Viscounts' eldest sons.
Earls' youngest sons.
Barons' eldest sons.
Knights of the Garter.
Privy Councillors.
The Chancellor of the Order of the Garter.
The Chancellor of the Exchequer.
The Chancellor of the Duchy of Lancaster.
The Lord Chief Justice of the Queen's Bench.
The Master of the Rolls.
The Lord Chief Justice of Common Pleas.
The Lord Chief Baron of the Exchequer.
Lords Justices of the Court of Appeal in Chancery.
Vice-Chancellors.
Judges and Barons of the Coif (the Judge of the Court of Probate has rank and precedence with them according to the date of his appointment. When sitting in the full Court of Divorce and Matrimonial Causes he ranks after the Chief Baron).
Knights Bannerets, Royal (made by the Sovereign in person in open war).
Viscounts' younger sons.
Barons' younger sons.
Baronets.
Knights Bannerets (not made by the Sovereign in person).
Knights Grand Crosses of the Bath.
Knights Grand Crosses of the Star of India.
Knights of St. Patrick.
Knights Grand Crosses of St. Michael and St. George.
Knights Commanders of the Bath.
Knights Commanders of the Star of India.
Knights Commanders of St. Michael and St. George.
Knights Bachelors.
Companions of the Bath.
Companions of the Star of India.
Cavalieri and Companions of St. Michael and St. George.
Eldest sons of the younger sons of peers.
Baronets' eldest sons.
Eldest sons of Knights of the Garter.
Bannerets' eldest sons.
Eldest sons of Knights of the Bath, and of St. Michael and St. George.
Eldest sons of Knights Bachelors.
Baronets' younger sons.
Younger sons of Knights of the Garter.
Younger sons of bannerets.
Younger sons of Knights of the Bath.
Younger sons of Knights Bachelors.
Esquires.
Gentlemen entitled to bear arms.
Clergymen, Barristers at Law, and officers of the army and navy.
Citizens.
Burgesses, &c.

Table of Precedence among Women.

[Married women and widows are entitled to the same rank among each other as their husbands would respectively have borne among themselves unless such rank is merely professional or official; and unmarried women to the same rank as their eldest brothers would bear during the lives of their fathers.]

The Queen.
The Princess of Wales.
Princesses, daughters of the Sovereign.
Princesses and duchesses, wives of the Sovereign's sons.
Grand-daughters of the Sovereign.
Wives of the Sovereign's grandsons.
Sisters of the Sovereign.
Wives of the Sovereign's brothers.
Aunts of the Sovereign.
Wives of the Sovereign's uncles.
Duchesses.
Wives of the eldest sons of dukes of royal blood.
Daughters of dukes of royal blood.
Marchionesses.
Wives of the eldest sons of dukes.
Daughters of dukes.
Countesses.
Wives of the younger sons of dukes of royal blood.
Wives of the eldest sons of marquises.
Daughters of marquises.
Wives of the younger sons of dukes.
Viscountesses.
Wives of the eldest sons of earls.
Daughters of earls.
Wives of the younger sons of marquises.
Baronesses.
Wives of the eldest sons of viscounts.
Daughters of viscounts.
Wives of the younger sons of earls.

Wives of the eldest sons of barons.
Daughters of barons.
Maids of Honour.
Wives of Knights of the Garter.
Wives of bannerets.
Wives of the younger sons of viscounts.
Wives of the younger sons of barons.
Wives of baronets.
Wives of Knights Grand Crosses of the Order of the Bath.
Wives of Knights Grand Crosses of St. Michael and St. George.
Wives of Knights Commanders of the Order of the Bath.
Wives of Knights Commanders of St. Michael and St. George.
Wives of Knights Bachelors.
Wives of Companions of the Bath.
Wives of Cavalieri and Companions of St. Michael and St. George.
Wives of the eldest sons of the younger sons of peers.
Daughters of the younger sons of peers.
Wives of the eldest sons of baronets.
Daughters of baronets.
Wives of the eldest sons of Knights of the Garter.
Daughters of Knights of the Garter.
Wives of the eldest sons of bannerets.
Daughters of bannerets.
Wives of the eldest sons of Knights of the Bath.
Daughters of Knights of the Bath.
Wives of the eldest sons of Knights Bachelors.
Daughters of Knights Bachelors.
Wives of the younger sons of baronets.
Wives of esquires and gentlemen.
Wives of citizens, burgesses, &c.

By the acts of Union of Scotland and Ireland the precedence in any given degree of the peerage has been established as follows:—1. Peers of England; 2. Peers of Scotland; 3. Peers of Great Britain; 4. Peers of Ireland; 5. Peers of the United Kingdom and Peers of Ireland created subsequent to the Union.

PRECEDENT, in law, a judicial decision which serves as a rule for future determinations in similar or analogous cases. Precedents, strictly speaking, are binding on tribunals only when they are in the form of actual decisions of the point in question; what is termed an extrajudicial opinion—the opinion of a judge pronounced where it was not called for to decide the issue—can have authority only from the character of the judge, and not as a precedent. While the principles of equity remained unsettled it was considered by many that precedents were inapplicable in that branch of law, as its very name seemed to imply that each case should be governed by the judge's opinion of its individual merits. This supposition has now, however, been refuted, and precedents are of as much authority in courts of equity as in those of common law. Forms of proceeding to be followed in similar cases are also termed precedents.

PRECENTOR (Latin, *præ*, before, and *cantor*, singer), in ancient religious foundations, the official in a chapter, whether cathedral or collegiate, who led the singing of the choir or congregation. It was his province to begin the verse, whilst the people joined with him at the close, a method which was often varied in the same service with antiphonic or alternate psalmody. He ranked generally, although not universally, next to the dean; but in modern cathedral foundations he is usually a minor canon, and in consequence has lost much of his precedence. He is still, however, everywhere the conductor of the choral service, and superintendent of the choir. In the Presbyterian Church it was formerly the habit of the precentor to repair to church half an hour before the minister came, and read to the people several passages of Scripture. When the minister entered the precentor gave out a psalm, and led the singing. After the beginning of last century he ceased by degrees either to read the Scripture or to prescribe the psalm. But his desk, which is generally placed beneath the pulpit, is still called the lectern (Scotch, *lettran*), that is, reading-desk. The practice of the precentor reading each line of the psalm previous to singing it is still kept up in some of the rural districts of Scotland.

PRECEPTORY, in medieval history, a religious house of the Knights Templars, subordinate to the temple or principal house of the order in London. It was under the government of one of the more eminent knights, whom the grand-master created and styled *Præceptor Templi*. It usually stood on a manor or estate belonging to the order, on which was also a church and other necessary buildings. Of these preceptories sixteen are said to have belonged to the Templars in England.

PRECESSION OF THE EQUINOXES, a slow motion of the equinoctial line, or line of intersection of the equator and ecliptic, which causes the positions occupied by the sun at the equinox (the equinoctial points) to move backward or westward at the mean rate of 50·25″ per year. This sweeping round in the heavens of the equinoctial line indicates a motion of the axis of rotation of the earth, such that it describes circles round the poles of the ecliptic in 25,791 years. Nutation (*nutatio*, a nodding) is a similar, but much smaller motion of the axis, whose period is about nineteen years. The axis, therefore, follows a sinuous path, instead of a circle, about the pole of the ecliptic. Nutation causes the equinoctial points to be alternately in advance and behind their mean place due to precession by 6·87″. At present the vernal equinoctial point is in the zodiacal sign Pisces, and it is moving towards the sign Aquarius.

Sir William Thomson has devised a mechanical illustration of precession. An ordinary 24-inch model of the earth, the southern parts of which are cut away, is supported on a pivot at the centre. At the north pole there is a small shaft which is not fixed in bearings, but merely rests against the inner side of a ring about 9 inches in diameter. The diameter of the ring subtends an angle of 47° at the centre of the globe. To cause the shaft to lean against the ring the globe is made top-heavy. The ring is fixed. When the globe is rotated the shaft rolls round the ring, and its motion is opposite to the rotation of the globe. If the shaft were made so small that it moved round $\frac{1}{25791}$th part of the circumference during about 365 rotations of the globe, this illustration of the earth's precessional rotation would be perfect. To represent nutation as well, it would be necessary to have about 1350 sinuosities in the ring. The ecliptic is represented by a plane through the centre of the globe parallel to the ring. When an ordinary top spins, it may be noticed that although one point of the axis of rotation is on the ground, and may be immovable, all other points in the axis have a circular motion. It is also to be noticed that the rotation of the axis itself is in the same direction as the rotation of the top about the axis. The top's motion is said to be one of 'positive precessional rotation.' Now, if the point of support of a rotating body be *above* its centre of gravity, it is found that the precession is 'negative,' or the rotation of the axis itself is opposite to the rotation of the top about its axis. In fact, the axis of a body supported in such a way that before rotation it is in unstable equilibrium is capable of taking a positive, and the axis of a stable body is capable of taking a negative precessional rotation. Now precession of the axis of the top is due to the action of a couple such as would tend, if the body had no rotation, to move it from its position of equilibrium; a couple produced by the weight of the top when its axis is not quite vertical. The effect of a couple on a rotating body is well known in dynamics, and may be studied experimentally with a gyroscope. The couple is numerically equal to the moment of momentum which it tends to produce in the body in a

unit of time. When a couple acts upon a body already in rotation its effect may be calculated in the following way. Let a line be drawn from a point in the body, representing the previous rotation, in such a way that it is parallel to the axis of rotation, and its length is numerically equal to the body's moment of momentum; but let this length be measured in a direction regarded as positive (an eye at the extremity of the line ought to see the body rotating in a direction against the hands of a watch). Let another line be drawn from the same point in the same manner, parallel to the axis of the couple, and let its length be numerically equal to the couple. Complete the parallelogram of which these are the sides, and the diagonal will represent the new circumstances of the body's rotation at the end of a second. Now the earth rotates about an axis which is inclined to the ecliptic, so that, except at the equinoxes, one-half of its equator is always above and the other half below the ecliptic. The sun attracts the earth, not as a whole, it is to be remembered, but as consisting of an infinite number of particles; and because of its being nearer, a quantity of matter on the earth is more attracted towards the sun during the day than at night. Hence, as the earth has an equatorial protuberance, and as one-half of this protuberance is more attracted towards the sun than the other; and as these halves are on opposite sides of the ecliptic, the attraction of the sun on the earth is not to be represented merely by a force acting in a line through the earth's centre, but by such a force and a couple. The couple tends to turn the earth, so that its equator may be in the plane of the ecliptic, and although its amount varies periodically, being greatest at the solstices and zero at the equinoxes, the direction in which it tends to turn the earth is always the same. We find that the precession due to this couple is negative; viewed from beyond the north pole the earth turns on its axis against the hands of a watch, but the axis is itself moving very slowly with the hands of a watch. The moon exerts an attractive force on the earth through the centre of gravity, and also a couple tending to turn the equatorial parts of the earth into the plane of the moon's orbit. The moon's orbit makes an angle of only about 5° with the ecliptic, and therefore the general tendency of the couples of the sun and moon is the same. The moon's couple is zero twice during the month (when the moon is at the nodes of her orbit), and it reaches a maximum value twice in the month. The 'retrogression of the moon's nodes' (which see), which is due to the motion of the moon about the earth being a precessional rotation, is a change in the position of the nodes, the whole period or time of describing the orbit being about nineteen years. Thus there is a periodic variation in the moon's couple, whose period is about nineteen years. We see then that, leaving out of account the actions of planets, the phenomenon called precession of the equinoxes is made up of: 1. A conical motion of the earth's axis in space, whose period is 25,791 years. 2. A variation in the velocity of this motion, whose period is half a year. 3. A nodding of the axis nearly to and from the pole of the ecliptic, whose period is half a month. 4. A much graver nodding, whose period is about nineteen years.

Green's Theorem (the 'potential' theorem) shows how to calculate the couples due to the attractions of the sun and moon, from pendulum observations at a small number of places on the earth. The probable error in this calculation is certainly not greater than 0·005. The angular velocity of the earth is known, and the amount of precession has been carefully observed. From these data the moment of inertia of the earth about its polar axis has been calculated. We know the mean density of the earth (from 5 to 6 times that of water) from Cavendish's and other experiments; but there are an infinite number of ways in which the matter of the earth might be arranged with regard to density to give the calculated moment of inertia. It is, however, found that if from any of the laws of variation of density which have been suggested, and which lay claim to any probability (Laplace's is the most probable), we calculate the moment of inertia, regarding the earth as a perfectly rigid body, we get a result which is within 5 per cent. of the actual moment of inertia calculated from precession, while the result from Laplace's law agrees with this amount within 0·2 per cent. But if we do not suppose the earth to be rigid we get an enormous discrepancy. In fact the existence of a considerable quantity of fluid inside the earth would cause precession to have a comparatively short period, and any degree of viscosity in the fluid between perfect rigidity and perfect fluidity would cause a rapid subsidence of all the rotatory motions. Sir William Thomson, to whom three independent solutions of the problem of the rigidity of the earth are due, illustrates the influence of internal fluid matter on rotation by means of experiments with boiled and unboiled eggs, vessels of water, oil, treacle, and sand similarly suspended by wires, &c.

PRECIOUS STONES. See GEMS.

PRECIPITATE. In chemistry this name is applied to a solid body produced by the mutual action of two or more liquids; thus if sulphuric acid be added to an aqueous solution of barium chloride, barium sulphate is produced, and being insoluble in the menstrua present it precipitates, or sinks as a solid to the bottom of the liquid in the vessel. So again, if a solution of potassium iodide be added to a solution of lead chloride, a reaction takes place resulting in the formation of lead iodide and potassium chloride, and inasmuch as the former of these bodies is, under the circumstances, a solid, it is precipitated. As a general rule it may be laid down that if it is possible to produce a solid substance by the action of two liquids on one another, that solid will be produced when these liquids are mixed, and that therefore a precipitate will be formed.

PRECOGNITION, in Scotch law, is an examination by the judge-ordinary or justices of peace, usually conducted under the superintendence of the procurator-fiscal, where any crime has been committed, in order that the facts connected with the offence may be ascertained, and full information given to the public prosecutor to enable him to prepare the libel and carry on the prosecution. In this investigation the witnesses are not usually put upon oath, and they must be examined separately; nor is the accused, or any person on his behalf, allowed to be present while it is going on. The accused cannot cite witnesses in exculpation, nor is he allowed to see a copy of the precognition after it is taken. Those who know anything of the fact may be compelled to come forward; the magistrate officiating at the precognition grants a warrant to summon them, which, if not complied with, will be followed by a warrant of imprisonment. If the accused make a reasonable suggestion as to the propriety of precognoscing a particular individual, the judge-examinator may cite and examine the person named as likely to establish the innocence of the accused. The precognition should be reduced into writing, and signed by the witnesses. The duty of conducting precognition now belongs to sheriffs, magistrates of burghs, and justices of the peace.

PREDESTINATION, in theology, the term used to denote the decree of God, whereby the elect are foreordained to salvation. Theologians have generally foreborne to use the word predestination with

respect to the rejected, using instead the word reprobation, as 'it is wicked to say that God has predestinated anything but good' (nefas est dicere Deum aliquid nisi bonum prædestinare—St. Augustine). The theory of predestination represents God's absolute will as determining the eternal destiny of man, not according to the foreknown character of those whose fate is so determined, but according to God's own choice. This doctrine has been the occasion of many disputes and controversies in the church in all ages. On the one side, it has been observed that it is impossible to reconcile it with our ideas of the justice and goodness of God, that it makes God the author of sin, destroys moral distinction, and renders all our efforts useless. On the other side, it is contended that if God's knowledge is infinite and unchangeable he must have known everything from eternity; if we allow the attribute of prescience the idea of a decree must be believed also, for how can an action that is to come to pass be foreseen if it is not determined either to do or to suffer it? If God is infinitely wise it cannot be conceived that he would leave things at random, and have no plan. The first great champions of these opposite views were Pelagius and Augustine. The former held the decrees of God as subordinated to the divine knowledge of human character; that there was a possibility of good in man's nature, and that the choice of salvation lay in man's will. Augustine maintained that God's decrees were absolute, and independent of all prior human conditions; that apart from divine grace there is no possibility of good in human nature, and that since the fall man's will has no power of choice. The system of Augustine was adopted in 529 by the Council of Arausio as the rule of orthodoxy in the Western Church. It forms one of the peculiar characteristics of the Calvinistic theology. The question as to God's moving cause in election, whether it is his sovereign will or his foresight of the character of the chosen one, is left undecided by the Anglican Church, and also by the Roman Catholic Church since the Reformation.

PREDICABLES. In those systems of logic which found their theory of definition and division on the scholastic and Aristotelian opinions that theory rests for both processes on the scheme of the predicables. Predicables are terms affirmable, as predicates, of other terms. Further, the identical affirmation of singulars being neglected, all predicables are said to be common terms. All the common terms which are affirmatively predicable of others, must import, with respect to the subject of the proposition, one or other of five things. The predicables are therefore five: genus, species, difference, property, and accident. The first two name the higher and lower classes of the things classified: a genus includes more than one species. The other three express the attributes on which the classification is founded.

PREDICATE, QUANTIFICATION OF THE. See QUANTIFICATION OF THE PREDICATE.

PRE-EXISTENCE, DOCTRINE OF. Some philosophers have maintained that the soul of every individual man has an existence previous to that of his body. This opinion was very prevalent in the East, and something like a belief of it is implied in the question which some of the Jews put to our Saviour respecting the blind man—Did this man sin, or his parents, that he was born blind? the obvious inference being, that if it was the man who had sinned, it must have been in some pre-existent state before he became an inhabitant of this world. The same opinion was held by several Greek philosophers, more especially by the Pythagoreans, Empedocles, and also by Plato himself, unless we are to consider the views stated by the last to be an allegory, rather than a sober statement of belief. A similar doctrine has found some countenance in Christian times among those who were anxious to explain how the soul becomes united to the body, but could not divine any more plausible hypothesis than that all souls were created before the world, and that each has its proper body allotted to it at the time of birth. In favour of this theory appeal is made to these peculiar sensations which are sometimes raised by sights or sounds, which we feel conscious of having had a former familiarity with, though reason would persuade us we had seen them for the first time. The doctrine is supported by the latest school of German philosophy, headed by the younger Fichte.

PRÉFET, the title of an important political functionary in France. Previous to the time of Henry II. the officers who were sent round to the provinces to superintend the details of administration on behalf of the sovereign were called *maîtres des requêtes*. That king established them in 1551 as perpetual overseers in all the provinces, and under Louis XIII. in 1635 they received the name of *intendants*. They were bound to unconditional obedience to the ministers, and could be recalled at any time. To their functions belonged the proportional assessment of taxes, the levying of soldiers and their removal, the procuring of supplies for the army and the royal magazines; the keeping of roads, bridges, and public edifices in repair; the care of the common concerns of the districts, the regulation of the trade in corn from one province to another, &c. It was often suggested to introduce, instead of these single functionaries, invested with such arbitrary powers, an administration by public bodies, a part of whose members at least should be chosen by the provinces themselves. But this was never done; and the office of intendants remained till the revolution, and the abuses of their authority contributed not a little to produce this catastrophe. It was therefore one of the first doings of the national convention to abolish these offices, and instead of them to erect in each department a general administration, whose members were chosen by the citizens. A directory of the department was permanent; a council, on the other hand, was to meet every year to fix the expenditures of the department, to audit accounts, and to exercise a degree of legislative power over the affairs of the department. A similar regulation was introduced in the districts and single towns. But by this organization the power of the government was much weakened, and the authorities of the departments often came forward in open opposition to the ministry. It was therefore one of the first operations of Napoleon to restore the intendants—not, however, under this odious name, but under the appellation of *préfets*. This was accomplished by the law of February 17, 1800 (28 Pluv. year VIII.), by which there was established for each department a préfet (to be appointed and dismissed at pleasure by the first consul), a council of the prefecture, consisting of three to five members, and a general council of the department. The last, also, appointed by the first consul, was to assemble once a year to distribute the quota of the departmental taxes among the districts (*arrondissements* or under-prefectures), to fix the expenses of the department, to decide on remonstrances respecting excessive taxation, and to audit the accounts of the préfets respecting the departmental treasury. But it seems that these *conseils généraux de département*, as well as the *conseils d'arrondissement*, were tacitly suffered to fall into disuse. The préfets are intrusted with the whole organization and management of the police establishments; but the punishment of offences against the police regulations belongs to particular courts not under their control. Within this sphere of action the préfets are

unchecked; the sous-préfets, who are appointed by them, and who stand at the head of the districts, are entirely subject to their commands; and the authorities of the communes, as well as the justices of the peace, can set no limits to their activity. In time of tumult they can call out the military, or provisionally declare a state of siege. The courts have no cognizance of any matter which has already been decided by an act of prefecture (*arrêté* of the préfets, or council of the prefecture), even though the officers may have exceeded their powers until that act has been voided by the competent authorities. By means of the préfets the ministry can exert a great influence, not merely on public, but also on private affairs. How the administration of penal justice, the elections, &c., were managed by them according to the purposes of the ministers, is notorious. The power of the préfets, however, ceases, at least by law, as soon as a legal contest arises respecting a subject of administration, for he must refer such cases to the court appointed for the purpose, the council of the prefectures, of which he is the president, but in which he has only a casting vote. Under the cognizance of this court fall all disputes respecting the taxation of particular individuals, respecting contracts for supplies, engagements with the state for building, the indemnification of those who have had to give up anything to the public, or have been injured by the contractors for public buildings, together with injuries sustained in war, contests respecting any of the public domains, &c. The appeals against its decisions (*arrêtés*) lie to the council of state.

PREGNANCY, the state of a female who is with child. Pregnancy begins at the moment of conception, and ceases with that of birth. During pregnancy the vital activity, especially of the womb, which probably receives a few days after conception the fecundated vesicle, increases. The periodical discharge of blood ceases, but the vessels of the womb become enlarged, more charged with blood, longer and straighter. Its cellular substance becomes softer and more spongy, the sides thicker, the cavity wider. It loses the pear shape which it has when not impregnated, and becomes more globular. It sinks during the two first months of pregnancy lower into the pelvis, but afterwards rises and becomes larger, until in the eighth month the bottom of it can be felt externally in the region of the stomach. In the ninth month it sinks again somewhat. In these changes of the womb the embryo (which see) develops itself until it has reached in the fortieth week a sufficient degree of maturity to be able to live separate from the mother, when the birth takes place, and pregnancy is at an end. But the vital activity is increased in the state of pregnancy, not only in the womb, but in the whole body with healthy and vigorous women. Pregnant women are bolder, more independent, more enterprising, stronger than before, and retain these qualities when they are mothers. They are more rarely affected by contagious diseases; consumption is checked during pregnancy, but makes the more rapid progress after its completion. Hysteric women feel often uncommonly well during this period; the gouty are freed from their attacks; some become uncommonly fat. On the other hand, this state is with many, particularly with feeble, sickly, delicate, too young or too old women, often accompanied by a great many complaints which depend upon the altered state of the systems of the vessels and nerves. The stomach particularly often suffers; hence nausea, vomiting, a morbid loathing of or craving for particular dishes, which were till then indifferent. Pregnant women often suffer also by wandering pains, particularly in the teeth, and by coughing. Much inclination exists in the body to inflammation and a heated state of the blood; the veins of the feet and the posteriors are swelled. The mechanical pressure of the womb, thus changed in situation and form, not unfrequently causes irregularities in the discharges of the urine and excrements. All these changes serve as signs of pregnancy. Other signs are the gradual and regular changes observed at the opening of the womb by internal examination; also the state of the breasts, which become larger during pregnancy, and in which a milky substance collects, but particularly the change of colour round the nipple; lastly, the motion of the child felt by the mother in the second half of the period of pregnancy, and the perception of different parts of the fœtus by external and internal examination. It is very important to determine the fact of pregnancy at an early stage; but it is very difficult in some cases, particularly in the first half of the period, because there are a number of diseases of the abdomen which are attended with similar symptoms. Pregnancy itself is subject to a number of deviations from the ordinary course. The rules laid down to prevent injury to the embryo, and to preserve the health of the mother, have reference principally to air, nourishment, and exercise; to the natural desires and preternatural longings (the latter must be gratified with much caution); to the passions, which must be carefully restrained; to the imagination, because the whole nervous system may easily become overexcited; to the proper allowance of sleep, and the disposition of the dress, which must not press either the abdomen or the breast. All injuries from overexertion or mechanical causes are to be carefully avoided, as falls, lifting, blows, &c., because they may easily occasion abortions. During pregnancy care ought also to be taken that the breasts are fit after the birth of the child to nourish it. It is a mistaken idea that abortions take place much more frequently among the higher classes. The poorer classes in populous cities are quite as liable to them. In the country, where a purer air keeps the body altogether in a more vigorous state, abortions occur less frequently. The advice of experienced female friends during the whole period of pregnancy is of course of the greatest value; yet in almost all countries certain prejudices exist respecting this important state in a female's life, and the advice of a physician cannot be dispensed with. The internal examinations mentioned above are comparatively rare in Britain and the United States; but in France, Germany, and Italy, if not throughout the European continent, they belong to the regular course of medical attendance in the state of pregnancy.

PREGNANCY, CONCEALMENT OF. It is enacted by 24 and 25 Vict. cap. c. (1861) that every person who shall, by any secret disposition of the dead body of a child, whether such child died before, at, or after its birth, endeavour to conceal the birth thereof, shall be guilty of a misdemeanour punishable with imprisonment not exceeding two years, with or without hard labour. If the woman gave notice to the putative father of the child during her state of pregnancy, there is no case against her. A strong case can be made out against the mother if she has made no preparations for her delivery, nor provided clothes for the child.

PREHNITE, a hydrated silicate of aluminium and calcium, containing about 45 per cent. of silica, 25 of alumina, with 25 of lime, and small amounts of potash, oxide of iron, &c. It belongs to trap-rocks and sienite, in which it is found in the form of veins and geodes. It is found in South Africa, from whence it was first brought by Colonel Prehn; in Scotland, and in many other places.

PRELATE, in church law those spiritual dignitaries who exercise jurisdiction in their own name. These were originally only the bishops, archbishops, patriarchs, and the pope. The cardinals and legates, abbots and priors, also obtained certain privileges of jurisdiction by grant or prescription. In the German Empire, previous to the secularizations of 1803, a number of high ecclesiastics, who held immediately of the emperor, had also a secular jurisdiction, and several had the princely dignity, with a seat and voice in the diets. The term prelates is often used merely to signify the higher dignitaries of the church.

PRELUDE, in music, a short introductory strain preceding the principal movement, performed on the same key as it, and intended to prepare the ear for the piece that is to follow. It may consist of a series of unconnected chords when the intention is simply to attract the attention of an audience, or to fill a singer's ear with the key in which the piece is written, in which case it is generally improvised. It is, however, usually composed of part of the leading theme, more or less varied towards the close, and is not left to the invention of individual performers, but is written by the composer or arranger himself.

PREMISES. See LOGIC.

PREMONSTRATENSIANS, or NORBERTINES, a religious order, founded in the French bishopric of Laon by Norbert, a canon of Xanten in Cleves, who, by the austerity and zeal which he manifested as Archbishop of Magdeburg in 1127 acquired the honour of canonization. In the forest of Coucy, in a meadow pointed out to him, as he said, by Heaven (*pré montré, pratum monstratum;* thence the name of the order), he collected his first disciples (1120), and gave them the rule of St. Augustine with some additional rigour. The Premonstratensians therefore consider themselves as regular canons, though by their constitution they are actually monks. Their order increased rapidly; several nunneries were established with the same rigid rules—at first in the neighbourhood of the monasteries, from whose revenues they were supported, but subsequently at a distance from them, to avoid the dangers of intercommunication. The abbot of the original monastery Prémontré, near Coucy, was general, and with three other abbots formed the great council of the fathers of the order. The order was introduced into England in 1146, and its members were there regularly known as the White Canons. Before the Reformation they had 2000 monasteries, among which were 500 nunneries, mostly in Germany, the Netherlands, France, England, and the north of Europe; but the Reformation diminished this number by more than one-half in the sixteenth century. The monasteries in Spain attempted to revive their discipline in 1573 by uniting in a strict observance of their rules, but they remained in communion with those of the common observance. In 1630 this communion of all the monasteries of both kinds was confirmed by new statutes. In the eighteenth century the order had no houses in Italy; in France it had forty-two monasteries; the nunneries had all disappeared. It now consists of a few houses in Poland and the Austrian states, especially in Bohemia, where it has at Prague one of its handsomest and richest monasteries.

PRENZLAU, or PRENZLOW, a town, Prussia, on the Ucker, where it issues from the north extremity of Lake Ucker, 57 miles north by east of Berlin. It is divided by the river into an old and a new town, is defended by two forts, is well built, and has among its buildings a handsome Gothic church and a gymnasium. Its trade is chiefly in grain, cattle, and tobacco. In 1806 a Prussian corps under Prince Hohenlohe surrendered here after the battle of Jena. Pop. (1875), 15,731.

PREPOSITION (from *præpositus*, placed before), a part of speech which is used to show the relation of one object to another, and derives its name from its being usually placed before the word which expresses the object of the relation. In some languages this relation is often expressed by changes of the termination (cases) without the use of a preposition.

PRESBURG. See PRESSBURG.

PRESBYTERIANS. The term Presbyterian comes from the Greek *presbuteros*, which signifies elder, and is applied to that body of Christians who hold that there is no order in the church as established by Christ and his apostles superior to that of presbyters, and who vest church government in presbyteries, or associations of ministers and ruling elders, possessed all of equal powers, without any superiority among them, either in office or in order. The Presbyterians believe that the authority of their ministers to preach the gospel, to administer the sacraments of baptism and the Lord's supper, and to feed the flock of Christ, is derived from the Holy Ghost by the imposition of the hands of the presbytery; and they oppose the Independent scheme of the common rights of Christians by the same arguments which are used for that purpose by the Episcopalians. They affirm that all ministers, being ambassadors of Christ, are equal by their commission; that the words presbyter (*presbuteros*) and bishop (*episkopos*) are synonymous and interchangeable terms; and that Prelacy was gradually established upon the primitive practice of making the moderator, or speaker of the presbytery, a permanent officer. These positions they maintain against the Episcopalians by the following arguments:—They observe that the apostles planted churches by ordaining bishops and deacons in every city; that the ministers, who in one passage are called bishops, are in another styled presbyters; that we nowhere read in the New Testament of bishops, presbyters, and deacons in any one church, and that therefore we are under the necessity of concluding bishop and presbyter to be two names for the same church officer. The identity of the office of bishop and presbyter being thus established, it follows that the presbyterate is the highest permanent office in the church, and that every faithful pastor is successor to the apostles in everything in which they were to have any successors. In the apostolic office there were indeed many things peculiar and extraordinary; such as their immediate call by Christ, their infallibility, their being witnesses of our Lord's resurrection, and their unlimited jurisdiction over the whole church. These powers and privileges could not be conveyed by the imposition of hands to any successors; but as rulers and office-bearers in particular churches we have the confession of the 'very chiefest apostles,' Peter and John, that they were nothing more than presbyters or pastors. This being the case, the dispute which has been so warmly agitated concerning the validity of Presbyterian ordination may soon be decided; for if the ceremony of ordination be at all essential, it is obvious that such a ceremony performed by presbyters must be valid, as there is no higher order of ecclesiastics in the church by whom it can be performed. Accordingly we find that Timothy himself, though said to be a bishop, was ordained by the laying on of the hands of a presbytery. At that ordination, indeed, Paul presided, but he could preside only as *primus inter pares;* for we have seen, that, as permanent officers in the church, the apostles themselves were no more than presbyters. If the apostles' hands were imposed for any other purpose, it must have been to communicate those *charismata* or miraculous gifts of the Holy Spirit which were then so frequent, but which no modern presbyter or bishop would scarcely pretend to give.

The first Presbyterian church in modern times was founded in Geneva by John Calvin about 1541; and the constitution and doctrines were thence introduced, with some modifications, into Scotland by John Knox about 1560, though the Presbyterian was not legally recognized as the national religion until 1592. For nearly a century after this date there was a continual struggle in Scotland between Episcopacy and Presbyterianism. The former, which was patronized by the court, was predominant in 1606; but was superseded by the latter, to which the great body of the people were attached, in 1638. At the revolution of 1660 Episcopacy again obtained the ascendency, which it lost in 1690, when Presbyterianism was finally established in Scotland; and by the Treaty of Union in 1707 it was agreed on the part of England and Scotland that that form of church government shall be the only form of ecclesiastical government in Scotland.—The constitution of the Scotch Church, and with certain unimportant modifications of the Presbyterian Church generally, is as follows:—The kirk-session is the lowest court, and is composed of the parochial minister, or ministers, if more than one, and of lay elders, the number of whom varies in different parishes; the minister, or senior minister, where there are more than one, is president or moderator. This court exercises the religious discipline of the parish; but an appeal may be made from its decisions to the presbytery, the court next in dignity. (See KIRK-SESSION.) The presbytery, from which there is a power of appeal to the synod, is composed of the ministers of a number of contiguous parishes, with an elder from each. A moderator, who must be a minister, is chosen every half year. A presbytery meets generally once a month, but it must at least meet once a year, and it may hold meetings on special occasions (*pro re natâ* meetings). This court takes young men on trial as candidates for license; ordains presentees to vacant livings; has the power of sitting in judgment on any of its members, and can depose them; and has the general superintendence of religion and education within its bounds. The synod, which meets twice a year, is formed of the ministers and elders of two or more presbyteries. A moderator, who must be a minister, is chosen at every meeting. The General Assembly is the highest ecclesiastical court, its decisions being supreme. (See ASSEMBLY, GENERAL.) Besides the Established Church there are three other important religious bodies whose constitution is strictly Presbyterian, but who, from different principles, decline being connected with, or receiving any emoluments from the state. These are respectively the Free, the United Presbyterian, and the Reformed Presbyterian Churches (see separate articles on these subjects).

Presbyterianism has never flourished much in England. In 1572 a presbytery was formed at Wandsworth in Surrey by ministers of London and its neighbourhood, who had separated from the Anglican Church, and several other presbyteries were soon formed, notwithstanding the extreme hostility of Queen Elizabeth. An attempt was made to render the Established Church presbyterian in the reign of Charles I.; and this object was signally promoted by the famous Assembly of Divines at Westminster. In 1649 presbytery was sanctioned by Parliament, but it was never generally adopted, or regularly organized, except in London and Lancashire. About 2000 (though some restrict the number to 800) Presbyterian clergy were ejected from their cures in consequence of the Act of Uniformity in 1662. Under the influence of such thinkers as Milton, Sir Isaac Newton, Locke, and Priestley, the more intelligent members of the Presbyterian Church were drawn towards Socinianism or Unitarianism, to such an extent that the name Presbyterian in England became synonymous with Unitarian; and many old endowments, the legacies of Presbyterians, are enjoyed by the Unitarians at the present day. Many churches in connection with the various Presbyterian bodies in Scotland are scattered throughout England.—The Presbyterian Church in Ireland originated through the settlement of some Scottish colonists in Ulster in the reign of James I. The members were not tenacious about matters of church polity, for some of the pastors received ordination from the hands of a bishop, and the people conformed without scruple to some of the ceremonies of the Established Church. The ministers were admitted at first to the privileges and emoluments of their Episcopalian brethren. In the reign of Charles I., and during the administration of Laud, the interests of the Irish Presbyterians suffered considerably; the statutes of the college at Dublin, authorizing the admission to its privileges and honours, were remodelled; their confession recognized in 1615 was set aside, and their ministers were ejected from their charges for nonconformity. During the Protectorate they were again raised to the status of ministers of the National Church. When Charles II. attempted to force Prelacy upon the Scotch, many of them took refuge in the north of Ireland, which gave the cause of Presbyterianism in that country a fresh impulse. This was not diminished by the accession of William of Orange to the British crown, for he had been educated in Holland to a decided preference for the doctrines and discipline of Presbyterianism. Nor did subsequent events tend to lessen his respect for the adherents of that system in Ireland; for when James II. landed there the Presbyterians rallied around the standard of the Protestant champion, and by their memorable defence of Londonderry, as well as the assistance they rendered at the battle of the Boyne, mainly contributed to the success of his arms. As a test of his gratitude he doubled the sum given for the support of their ministers, hence known as Regium Donum. This sum was repeatedly augmented until it reached the sum of £70 a year for each minister. The act of 1869, however, which disestablished the Irish Church, provided also for the discontinuance of this sum. Like their brethren in England, the Irish Presbyterians showed during the eighteenth century a decided leaning towards Arianism or Unitarianism. In 1830 a separation took place from the Arians, who then formed the Remonstrant Synod of Ulster. Ten years later a union was effected of the Presbyterian Church, forming the Synod of Ulster, and the Secession Church in Ireland, an offshoot of the Secession Church of Scotland.—The Presbyterian Church of the United States is undoubtedly to be reckoned as a daughter of the Church of Scotland. Presbyterians in large numbers began to emigrate from Scotland and the north of Ireland to the American colonies as early as 1689, and they quickly manifested a disposition to reproduce their peculiar institutions in their new homes. There were several churches established before the close of the century. The church of Rehobosh in Maryland dates from 1690, and the church on Elizabeth River in Virginia is believed to have had as early an existence. In 1705 or 1706 a presbytery was first formed in Philadelphia, and in 1716 a synod composed of four presbyteries was formed. The body rapidly increased by means of emigrants not only from Scotland and Ireland, but from Wales, France, Holland, and Switzerland. The consequence was that the church soon began to assume a rather heterogeneous character, and the harmony of its operations was proportionately diminished. The existence of two distinct parties could be clearly

recognized: those who were more jealous for orthodoxy, for a rigid adherence to Presbyterian rule, and for a thoroughly-educated ministry were called the old side; while those of the new side looked upon departures from ecclesiastical order with more forbearance, and were less particular in respect to other qualifications for the ministry provided they could have evidence of genuine piety. Violent dissensions ensued, and at last, in 1741, the synod was rent asunder, the old side constituting the Synod of Philadelphia, and the new side the Synod of New York; but seventeen years later they were united. In 1788 a General Assembly was instituted, composed of the four synods of New York and New Jersey, Philadelphia, Virginia, and the Carolinas. In 1801 a plan of union between the American Presbyterian Church and Congregationalists was formed, with a view to prevent disagreement between the two denominations, and under this arrangement numerous churches were founded in the states of New York and Ohio. In 1836 another division broke out in the church, which was split up into two distinct and independent sections, known as the Old School and New School Presbyterians; this was followed in 1869 by another reunion. Besides the Cumberland Presbyterians (a secession from the main body dating from the beginning of the present century), there exist in the United States numerous churches connected with the various denominations of Presbyterians in Scotland.

PRESCOT, a manufacturing and market town in England, county of Lancaster, 8 miles east of Liverpool. It is long and straggling, and stands principally upon a substratum of coal, several mines of which are excavated to its very edge. Prescot has long been noted for the manufacture of watch-tools, watch-movements, and hands. The drawing of pin-wire originated here, and small files of superior excellence are made, and exported in large quantities. The other manufactures are coarse earthenware, glass-bottles, nail and rope making. There are also a tannery, and several breweries. A railway passes through the town to connect Liverpool with St. Helen's and Wigan by a direct route. Pop. 5546.

PRESCOTT, William Hickling, a noted American historian, was born in Salem, Massachusetts, on 4th May, 1796. His father, William Prescott, was a lawyer of considerable standing, and the son of Colonel William Prescott, who commanded the American forces at the battle of Bunker's Hill. Young Prescott continued at Salem till the twelfth year of his age, when his father removed to Boston. In 1811 he entered Harvard College, and graduated in 1814. In the last year of his college life a classmate playfully threw a crust of bread at him, which struck him on the eye, completely depriving him of its use for ever afterwards. Excessive use of the other eye for study brought on a rheumatic inflammation, which left him entirely blind for several weeks, and rendered the eye too irritable to be employed in reading for several years. Subsequently he was able to use it for many hours a day, but it eventually became so weak, that during the latter half of his life he could read only for a few moments at a time, and could scarcely see to write at all. He had early resolved to devote himself to a literary life, and soon after leaving college proceeded to Europe, and spent two years in travelling through England, France, and Italy. He then returned to his native country, where he married, and set himself assiduously to literary labour. The earliest fruits of this were contributions to the North American Review, principally on Italian and French literature, but the subject for which his inclination and abilities more especially fitted him was history, and he accordingly selected for his first attempt the reign of Ferdinand and Isabella of Spain, a work on which was published in three volumes, at Boston, on the Christmas-day of 1837 (but dated 1838), under the title of the History of the Reign of Ferdinand and Isabella the Catholic. The success which this achieved was most decisive. It was received with the utmost enthusiasm both in America and Europe; it was rapidly translated into French, Spanish, and German; and its author was elected a member of the Royal Academy of Madrid. The popularity of the work continues undiminished, as is evinced by the numerous editions through which it has passed.

Mr. Prescott's next work was the History of the Conquest of Mexico, with a Preliminary View of the Ancient Mexican Civilization, and the Life of the Conqueror Hernando Cortez, which appeared in three volumes in 1843, and was received with an equal degree of favour to that which had greeted his History of Ferdinand and Isabella. In 1847 appeared, in three volumes, the History of the Conquest of Peru, with a Preliminary View of the Civilization of the Incas, like his previous writings a work of sterling merit.

A more extended work was now contemplated by Mr. Prescott, and the History of the Reign of Philip II., which he did not live to complete, was commenced. This he intended should be a *chef d'œuvre*, and no pains nor expense were spared by him to render the result commensurate with the undertaking. In connection likewise with the most extensive preparations made by himself, he received the most liberal co-operation from all quarters, public and private. Everywhere both public and private collections were thrown open to his inspection. In 1855 the first two volumes of the long-expected work appeared under the title of the History of the Reign of Philip II., King of Spain, and proved, on examination, that the anticipations of the public regarding it had neither been overstrained nor illusory. Like the former writings of Prescott, this history displays the same clear and lucid style, the same impartiality and research, and the same picturesqueness and fascinating interest of narrative.

In 1856 Mr. Prescott published an edition of Robertson's History of the Reign of Charles V., with notes and supplement, containing an account of the emperor's life after his abdication. In the end of 1858 appeared the third volume of the History of Philip II.; but the earthly career of its author was now almost completed. In the commencement of the last-mentioned year he had been visited by a slight stroke of paralysis, but this had yielded to the efforts of his physicians, and he seemed to have recovered his usual health and spirits. On the 28th of January, 1859, however, he was suddenly seized with apoplexy, and expired in about an hour and a half afterwards. He left a widow and three children, two sons and a daughter.

The labours of Prescott afford a remarkable instance of the success of indomitable industry and perseverance carried out in the face of what might otherwise appear almost insurmountable obstacles. Precluded by his affliction of partial blindness from consulting personally the authorities from which he drew his materials, he was in the practice of causing them to be read aloud to him by another. His first reader knew, however, no language but English. The historian 'taught him,' as he says, 'to pronounce the Castilian, suited, I suspect, much more to my ear than to that of a Spaniard. I cannot even call to mind without a smile the tedious hours in which, seated under some old trees in my country residence, we pursued our slow and melancholy way over pages which afforded no glimmering of light to him, and from which the light came dimly struggling to me through a half

intelligible vocabulary. . . . When we had toiled our way through seven quartos I found I could understand the book (Mariana's History) when read about two-thirds as fast as ordinary English.' He afterwards obtained the services of a reader acquainted with several of the continental languages. Prescott's mode of composition was as follows. His secretary first read to him all the books treating on the general subject, the historian dictating occasional memoranda as the reading went on. The plan of the work was then sketched, a division into chapters made, and the authorities for the topic of the first chapter gathered together and read to him carefully while he dictated notes of their contents. When the mass of these notes was read and re-read to him he sat down to write, using for this purpose a writing instrument consisting of a frame of the size of a sheet of quarto letter-paper traversed by as many brass wires as there were to be lines on the page, and with a sheet of carbonated paper, such as is used for getting duplicates, pasted on the reverse side. With an ivory or agate stylus he traced rapidly but rather illegibly the characters between the wires on the carbonated sheet, making indelible marks on the white page below. His secretary copied the manuscript as fast as it was written, and when the chapter was finished it was read to him several times, carefully revised, and again copied before being sent to the printer. He found this writing-case his best friend in his lonely hours, and with it he wrote nearly all that he sent into the world for the last forty years of his life. A life of this great historian, and amiable and pure-minded man, was written by his friend George Ticknor, and published in 1864. His contributions to the magazines have been collected and published, under the title of Biographical and Critical Essays, in America and in England (New York, 1845; London, 1861).

PRESCRIPTION, in law, is a right or title acquired by use and time, as when a man can show no other title to what he claims than that he, and those under whom he claims, have *immemorially* used to enjoy it. The object of prescription is to secure the title to property to him who has had the possession of it for the term fixed by the law, and to prevent any one from disturbing his possession after such term has expired. The law of prescription is not intended to punish the indolence of proprietors; it only interprets their silence as consent, presuming that a man who neglects to assert his right for a long series of years gives it up. In the English law the term *prescription* is applied only to incorporeal hereditaments, as a right of way, a common, &c. A prescription is distinguished from a custom by this, that custom is properly a local usage, and not annexed to a person, such as a custom in a manor, that land shall descend to the youngest son; but prescription is merely a personal usage; as that a certain man and his ancestors, or those whose estate he hath, have used, time out of mind, to have common of pasture in such a close; for this is a usage annexed to the person of the owner of this estate. By the law of England a prescription must have existed from time whereof the memory of man is not to the contrary, which is to be understood not merely of living memory, but of memory by means of records or other written memorials; and, therefore, where there is any proof of the original or commencement of anything, it cannot be claimed by prescription; unless, indeed, the commencement were before the reign of Richard I., for then it is considered to have existed immemorially, on an equitable construction of the statute of Westminster, 1, which limited that time for a writ of right. This continued to be the rule at common law till the passing of the statute 2 and 3 William IV. cap. lxxi., which provides that no right of common shall be defeated after thirty years' enjoyment, and after sixty years the right is deemed absolute and indefeasible, unless had by consent or agreement. In claims of right of way, of water-course, and similar easements, the periods are twenty and forty years. Claims to the use of light to any dwelling-house or building enjoyed for twenty years are indefeasible, unless shown to have been by consent.

By the law of Scotland prescription has a much wider operation than by the law of England, supplying the place of the statute of limitations of that system. It not only protects individuals from actions which other parties might have brought against them had the lapse of time not taken place, but in some instances creates a positive title to property. The prescription by which a right of property can be established is that of forty years. Whatever adverse right is not cut off by the other special prescriptions of shorter periods is destroyed by the long prescription, as this is called. To create a title to real property, the long prescription must be both positive and negative. The party holding the property must by himself, or those through whom he holds, have been forty years in unchallenged possession, and be able to show an infeftment or series of infeftments—this is called positive prescription. The claimant and those whom he represents must have been forty years without an ostensible title, and must, by not legally challenging it, have tacitly acquiesced in the possessor's title—this is called the negative prescription. Prescription is interrupted by an action raised in a competent court, and is suspended by the minority of any person who could challenge the opposing right; in the first case a new period of forty years has again to run, and in the second the years of the minority are not counted in making up the forty. The other and shorter prescriptions (called the lesser prescriptions) are as follows:—The vicennial or twenty years' prescription, applicable to holograph writings not attested with the usual solemnities of Scottish writs; the decennial or ten years' prescription, applicable to actions against tutors and curators; the septennial or seven years' prescription, applicable to actions against cautioners; the sexennial or six years' prescription, applicable to bills of exchange or promissory notes; the quinquennial or five years' prescription cuts off all right of action on verbal contracts, and arrears of rent in an agricultural lease; the triennial or three years' prescription, which cuts off claims for ordinary merchants' accounts, servants' wages, rent due on a verbal lease, and for services rendered by attorneys, surgeons, artificers, &c. By Scotch law also, but not by English, a vicennial prescription applies to crimes, no prosecution being competent after a period of twenty years.

PRESCRIPTION, in medicine, is the form, with directions, in which a medicine or medicines are ordered or prescribed by a medical man. In England both prescriptions and directions are usually written in Latin; in Scotland the directions are generally given in English. In prescribing the physician may, from the nature of the case, use an officinal or extemporaneous preparation. Officinal preparations are those for which formulæ have been introduced into the national pharmacopœias, and which are supposed, therefore, to be kept ready for use by all respectable dispensing chemists. In former times prescriptions were much more complicated than they are now, and certainly the simplicity may be regarded as a sign of increased medical knowledge and of greater confidence in the action of medicines. Some persons even contend that there should be no intermixture of medicines, but that one only should be given with a certain definite object, and allowed

to operate unembarrassed by the presence of others. This, however, would materially interfere with the efficiency of practical medicine, at least in the present state of our knowledge. The several medical substances which may be contained in a prescription are distinguished by medical writers by names indicative of the office which each of them performs. These are—1. The *basis*, which is the principal or most active ingredient. 2. The *adjuvant*, or that which is intended to promote the action of the basis; as tincture of senna added to infusion of senna in the ordinary black draught. 3. The *corrective*, intended to correct, modify, or control its action; thus, the addition of extract of hyoscyamus to the compound extract of colocynth renders the purgative action of the latter much less griping, yet not less efficacious. 4. The *excipient*, or that which gives the whole a commodious or agreeable form, and which, consequently, gives the prescription its peculiar character, as that of draught, mixture, pills, &c. To these certain continental writers add a fifth, the *intermedium*, which is the substance employed to unite remedies which do not mix with each other or with the excipient, such as yolk of eggs and mucilage, employed in the preparation of emulsions. In choosing the form of a prescription it should be borne in mind that solutions and emulsions generally act with more certainty and rapidity than powders diffused through water; and these again than the semi-solid and solid forms of medicine represented by electuaries, boluses, and pills. On these matters the taste and wishes of the patient should not be disregarded. The taste of nauseous medicines should be disguised as much as possible by the judicious selection of an appropriate corrective or excipient; thus the disagreeable flavour of Epsom salt may in a great measure be covered by dissolving it in peppermint-water, that of aloes by liquorice, that of castor-oil and cod-liver oil and copaiba by orange wine or water containing a bitter tincture; the bitterness of all bitter substances is concealed by strong coffee or tea.

PRESENTATION means the nomination of one or several candidates to a vacant office, as in the case of a patron to a church. Presentation is properly speaking merely a proposal, but when given by the true patron cannot be rejected except on cause shown. The investiture or induction, however, belongs to the person or body before whom the presentation is laid. In ecclesiastical benefices the usual rule is that if the patron fails to present within six months after a vacancy has been intimated to him, the *jus devolutum* takes place; in other words, the patron loses his right, which in consequence devolves on the party before whom the presentation should have been laid, as the bishop under Episcopacy, and the presbytery under Presbyterianism.

PRESENTMENT, in law, is properly speaking the notice taken by a grand-jury of any offence, from their own knowledge or observation, without any bill of indictment being laid before them at the suit of the crown; as the presentment of a nuisance, a libel, or the like, upon which the officer of the court must afterwards frame an indictment before the party presented can be put to answer it. The term is also used to include inquisitions of office, and indictments by a grand-jury; or to express the formal notice taken in copyhold courts of the deaths of tenants, surrenders and admittances taken out of court, and similar circumstances.

PRESERVED PROVISIONS, PRESERVES. The tendency of all dead organized matter which contains moisture is, at ordinary temperatures, to undergo chemical change, or in other words, the various vegetable and animal products, when deprived of life, decay. (See DECOMPOSITION, PUTREFACTION.) When these products are such as are employed for food, it of course becomes a matter of considerable importance to counteract this tendency to decomposition, by which the articles are speedily rendered useless. Fruits intended for confectionary are preserved in four different ways —1. In the form of jam, in which the fruit is boiled with from one half to about equal its weight of sugar. 2. In the form of jelly, in which the juice only is preserved, by being carefully strained from the solid portions of the fruit, and boiled with a third to a half its weight of sugar. 3. By candying, which consists in taking the fruits whole or in pieces, and boiling them in a clear syrup previously preserved. They absorb the syrup, which is then crystallized by the action of a gentle heat. 4. By stewing them in a weak syrup of sugar and water till they become soft but not broken, and transferring with the syrup to jars, adding pale brandy equal in quantity to the syrup. In this way stone fruits, such as cherries, peaches, and plums are preserved. Several kinds of vegetables, as cabbages, cucumbers, cauliflowers, onions, are preserved by pickling. (See PICKLES.) But to preserve large quantities of vegetable and animal products for food-purposes, so as to be used as nearly as possible as if they were in the fresh state, they must be either desiccated, or sealed in air-tight cases. With vegetables, which contain so large an amount of water in proportion to their solid and nutritious material, the process of drying is peculiarly applicable, and seems likely to be largely employed as the means of furnishing fresh vegetable food for ships in a compact and portable form, when, in addition to desiccation, compression is also employed. Vegetables such as cabbage, beans, pease, parsnips, sliced carrots, Brussels sprouts, spinach, potatoes, &c.; and fruits such as apples, pears, &c., are preserved by removing all the moisture from them, by drying either in a vacuum or by means of heated air, which reduces their bulk in many cases more than one half. They are then submitted to the action of powerful presses, which, besides again reducing their bulk considerably, makes them less liable to absorb moisture from the atmosphere. When vegetables thus prepared are immersed in water for some time they swell up, become soft and tender, and resume to a great extent the appearance, colour, and flavour proper to them in their fresh state. It is stated that 1 cubic yard of these dried and compressed vegetables contains as much as 16,000 rations, and that they are of better flavour and much cheaper than the vegetables preserved in canisters. The action of an elevated temperature, such as is employed in cooking food, must be regarded rather as a retarder than as a perfect preventive of putrefaction. When heat is combined with dryness it acts much more perfectly as a preservative. This is exemplified in the processes employed originally by the Indians of North and South America. See JERKED BEEF and PEMMICAN.

The preservation of articles of food by the application of cold is the simplest of all known methods, and in such climates as North America, Russia, &c., it is largely taken advantage of. Cattle and poultry are killed at the commencement of frost, allowed to become frozen throughout, and in this condition are brought to the markets of Montreal, Archangel, and St. Petersburg; fish are treated in the same way. Provisions thus preserved only require the precaution of being gradually thawed before use by immersion in cold water. Beef and game have been sent to Great Britain from America in many instances in capital condition. In Great Britain ice, as is well known, is largely used to pack salmon and fish generally in summer time.

One of the most extensive methods of preserving

provisions is by their impregnation with salt, but it is also the most pernicious and unphilosophical. Muscular tissue, of which flesh is composed, consists mainly of the animal albuminous principle known as *fibrin*, in a coagulated or semi-solid condition, permeated in all directions by a fluid composed partly of blood, and partly of substances secreted from it. This fluid, which constitutes nearly three-quarters, by weight, of all fresh meat, is composed of albumen in the soluble condition, the soluble salts of the blood, the crystallizable animal principles kreatine and kreatinine, lactic and butyric acids, the phosphates of potash, magnesia, and lime, and a small quantity of common salt—the whole being dissolved in a watery fluid. By the process of salting all these important substances are washed out in the brine, and in course of time nothing is left but hard fibrin, which affords little nourishment to the human body. A change in the gastric juice, and consequently in that of the products of the digestive process, must be regarded as an inevitable result of the long-continued use of salted meat; and if, during digestion, the substances necessary to the transformation of that species of food be taken from other parts of the organism, these parts must lose their normal condition.

From the above objections the process of preservation by exclusion from the action of atmospheric air is free, and is yearly assuming more importance and being more largely practised. The action of the atmosphere may be prevented in different ways; as by covering the articles with melted fat, immersing them in treacle, glycerine, weak vinegar, and several other liquids, but from one cause or other these methods have all failed practically. Sardines and other small fish have been preserved in oil in large quantities with success, but the principle, though sound, is from the expensive nature of the material inapplicable to provisions in large bulk. The most perfect method, and that which is now most generally resorted to, is the inclosure of the food in air-tight cases from which the air is then expelled; upon the perfection of the air-excluding process depends entirely the preservation of the article. The first successful attempt to preserve fresh meat was made by M. Appert, a Frenchman, who received, in 1810, a prize of 12,000 francs offered by the Board of Arts and Manufactures in Paris. The following year his colleague M. Durant took out a patent for the process in this country. This patent was purchased for £1000 by Messrs. Donkin, Hall, & Gamble, who at once effected a great improvement in Appert's method by substituting tin canisters for the glass cases formerly used. The plan now generally adopted is, with some modifications, as follows:—The provisions of whatever kind are packed into a tin cylinder, and the interstices filled in with water or other appropriate fluid, as gravy in the case of flesh-food. The lid, which is perforated with a small aperture or pin-hole, is soldered carefully down. The cases are then set in a water bath in which muriate of lime is dissolved, and heat is applied until the whole boils, and the air is expelled through the pin-holes. These holes are then hermetically closed, and the canister and its contents are once more subjected to the operation of heat until the provisions are perfectly cooked. When it has become cool the canister is coated over with paint and removed to the proving room, an apartment the temperature of which has been raised to the degree of temperature most favourable to decomposition. If the operation has been successfully performed, the ends of the canisters, and in some instances the sides will have fallen in to some extent from the outward pressure of the air. If, after the interval of some days, the ends are found to have bulged out, it is a certain sign that the contents have not been perfectly cured, or that the case has not been properly soldered; the liberated gases causing the outward pressure. Such cases should be rejected or submitted again to the process. Not only may boiled provisions be preserved in this way, but with a little more care roast meats also. An improvement on this process has been effected by introducing into the canisters a small quantity of sulphite of soda, which causes the absorption of any traces of free oxygen which may lurk in the cases.

Experiments were first made in Australia to ship fresh joints of beef and mutton, surrounded by a freezing mixture, or in some way treated by chemical solutions, to bear a three months' voyage through warm climates; but the results were not commercially profitable. In recent years, however, the experiment has been revived in America, and with more success; and in 1880 a cargo of fresh meat from Australia, preserved by an improved process, was landed in good condition in London. The making up of meat for exportation in canisters is now most extensively carried on in America, and it is in consequence mainly of the increased activity of this branch of trade there that the imports into Great Britain of beef and other kinds of meat preserved otherwise than by salting have increased from 171,373 cwt. in 1875, to 560,581 cwt. in 1882. In 1879 the value of this import was £1,693,520. The manufacture of a concentrated extract of meat upon a plan suggested by the celebrated chemist Liebig is now carried on extensively. It is chiefly used by invalids and children, and for making soups. Only the lean parts of the meat are used, and this is subjected to boiling until all but the fibrin is dissolved. The liquid is then concentrated until it has the consistency of a stiff paste, in which state it is easily preserved. Several authorities have lately expressed the strongest doubts as to the nourishing properties of extracts of meat obtained by this as well as by other processes; but it can hardly be doubted that they have some valuable properties as food, and the demand for them is steadily increasing.

PRESS, Correction of the. See Correction of the Press.

PRESS, Liberty of the, the liberty of every citizen to print whatever he chooses, which at the same time does not prevent his being amenable to justice for the abuse of this liberty. To make the liberty of the press real two things are essential: 1, that the laws against its licentiousness should be precise and clear; 2, that they should only punish what is really injurious to the public welfare. The laws for punishing abuses of the press are generally directed against attacks upon the government or its officers, upon the reputation of individuals, and upon good morals and religion. The latitude allowed to the press of course will vary with circumstances. A discussion will be permitted in Prussia which would be punished in Austria. Discussions of certain religious topics are considered in one age blasphemous, while another age esteems them innocent. As to charges affecting the character of governments and individuals we may observe that the freer a government is the less sensitive it is, and the less sensitive are the people who live under it. No people are so indifferent to being publicly spoken of as the British, whilst the Prussian code contains many laws against verbal offences. As the liberty of speech is unquestioned, and printing only gives permanence and circulation to what might be freely spoken (newspapers, for instance, take the place of speeches and conversations in the forums of the petty states of antiquity), the right of printing rests on the same

abstract grounds as the right of speech; and it might seem strange to a man unacquainted with history that printing should be subjected to a previous censorship, as it is in some states, any more than speaking, and that the liberty of the press should be expressly provided for in the constitutions of most free states. But when we look to history we find the origin of this, as of many other legislative anomalies, in periods when politics, religion, and individual rights were confusedly intermingled. It is only since men's views of the just limits of government have become clearer that the liberty of the press has been recognized as a right; and to England we are particularly indebted for the establishment of this principle, as of so many other bulwarks of freedom, though the Netherlands preceded her in the actual enjoyment of the liberty of the press. When we consider the practical effect of the censorship, it is no more defensible on that ground than on the ground of abstract right. In what times and countries have morals and religion, and the reputation of individuals, been more outrageously attacked through the press than in those in which the censorship was established? We are far from considering the liberty of the press as without evil consequences; but the censorship does not prevent these consequences, while it destroys the numberless benefits of an unshackled press. But the liberty of the press, properly considered, is not to be treated as a mere question of political expediency. Liberty of conscience and liberty of thought are rights superior in importance to any objects which fall under the head of expediency. Representative governments are empty forms without the liberty of the press. The free discussion of all political measures, and of the character of public officers, is of much more consequence than the freedom of debate in legislative assemblies. A parliament would be a comparatively small check upon a government were it not for the liberty of the press. In fact, it might easily be made an instrument for enforcing oppressive measures; since a government would find little difficulty in gaining over a majority of such a body by the motives of ambition and avarice, were it not for the control exercised over legislative bodies by a free press. Without this publicity of discussion in legislative assemblies would be of little avail. This liberty is the great safeguard of all others; and two French dynasties have been prostrated in a struggle with this formidable power. Polignac's Report, which caused the revolution of 1830, will ever be memorable in the history of the liberty of the press, as proving the difficulty or impossibility of a minister's ruling in opposition to public opinion in a country where the press is free.

In England the liberty of the press, soon after printing was introduced, was regulated by the king's proclamations, prohibitions, charters of license, &c., and finally by the court of Star-chamber. The Long Parliament, after their rupture with Charles I., assumed the same power. The government of Charles II. imitated their ordinances, and the press did not really become free till the expiration of the statutes restricting it in 1693, after which it was found impossible to pass new laws in restraint of it, and it has remained free ever since. In the article Books (Censorship of) an account is given of the regulations of various countries for restricting printing and the sale of printed matter. Where the government has the complete control of either no liberty of the press exists. In other countries the principal rules for the regulation of the press are: 1, that all presses must have a license; the printers must often give high security for their loyal behaviour, and sometimes even take an oath; 2, the name and place of residence of the printer must be mentioned on the title-page or on the last leaf. This is the case in Great Britain and on the continent of Europe. The printer must keep a list of all that he prints, and in some states must send copies to the government before publication. In France, if a work is found illegal, a criminal process is instituted, and the books are not allowed to be sold until the decision is given. Government need not prosecute immediately, but can at any time. By English law the publishers of newspapers must, under a penalty of £20, enter into a recognizance or bond of £400 or £300, together with sureties to pay any fine that may be inflicted on him for publishing a blasphemous or seditious libel. Before publication he must also state the correct title of the newspaper, together with the names of the printer, publisher, and, under certain reservations, those of the proprietors. In the United States there is no restraint upon the liberty of printing. Any man can print and circulate whatever he chooses, and is only answerable if the matter itself is illegal. What publications are punishable in the United States will depend in some measure upon the circumstances of the particular state in which they appear. In the slave-holding states publications of a tendency to excite commotions among the blacks were liable to punishment.

PRESS, Printing. See Printing.

PRESSBURG, or Presburg (Magyar, *Pozsony;* Slavonic, *Presburek*), a town in the west of Hungary, capital of the county of its own name, 35 miles east of Vienna, on the left bank of the Danube, which here divides into several branches, and is crossed by a bridge of boats. The site of the town is remarkably fine, being in the form of a semicircle, bounded on the south by the Danube, from the banks of which it gradually ascends to the west and north towards ramifications of the Carpathians; while an extensive plain, covered with gardens, vineyards, meadows, and corn-fields, forms its boundary on the east. In the town itself there is not much to attract attention. The fortifications have been dismantled, and the streets are for the most part narrow and steep, and only partially paved. The houses, however, are solidly built of brick or stone, and of two or three stories; and some of them, particularly in the suburbs, are very handsome. The edifices most deserving of notice are, the royal palace, on a height which overlooks the town, a building once of great magnificence, and still rich in historical recollections, but accidentally burned in 1811, and not since repaired; the Landhaus, or Hall of the Diet, in which the chambers of the kingdom used to meet, a plain structure; the cathedral, a huge Gothic pile with a lofty steeple, and less remarkable as a church than as the place where the kings of Hungary were formerly crowned; the Capuchin, Franciscan, and Ursuline monasteries, each with a handsome church attached; the Jesuit church, a synagogue, the town-house, theatre, bishop's palace, orphan hospital, and barracks. The manufactures consist of woollens, silks, leather, and tobacco. The trade, particularly transit, and chiefly in corn, is extensive. Outside the town is the artificial mound called the Coronation Hill (Krönungshügel), to which the newly-crowned kings of Hungary used to ride in grand procession and brandish the sword of St. Stephen towards the north, south, east, and west, signifying thereby that they undertook to defend the kingdom from danger, come from which quarter it might. Pressburg is a place of very great antiquity, and is said to have acquired some importance even before the country was subjugated by the Romans. It is certain that Duke Wratislaw possessed a castle here in the ninth century. In 1541, when the Turks captured Buda, it became the capital of Hungary, and retained the honour till the

Emperor Joseph II. restored it to Buda. The peace by which Austria ceded Venice to France and the Tyrol to Bavaria was concluded here in 1805. Pop. (1880), 48,284, fully more than half of whom are Germans. German is the prevalent language, the Magyar being cultivated only in the upper circles of society.—The county, area about 1250 square miles, is traversed by part of the Carpathian chain in the north, but in other directions is flat and tolerably fertile, though in several quarters covered with marshes. It is watered by the Danube, March, Waag, and Dudwaag, and yields corn, excellent wine, and abundance of wood. Pop. 314,147.

PRESS-GANG, the name given in England to a detachment of seamen who (under the command of a naval officer) were empowered, in time of war, to take any seafaring men and oblige them to serve on board the king's ships.

PRESSURE. When a body rests on the ground, at the surface separating it from the ground there are two equal and opposite forces acting, the weight of the body acting downwards, and an equal upward force, which may be called the resistance of the ground. Two equal and opposite forces of this kind distributed over an area are called a pressure, and dividing either of the forces by the area gives the mean pressure per unit area. It is customary to call the pressure existing at any cross section of a rod, or wire, or rope, which forces tend to make longer, a 'pull,' and to call the pressure at a cross section of a rod or beam or column, which the forces tend to make shorter, a 'push.' Thus we have the 'intensity of a push,' or of a pull, per unit area. At any little interface separating two small portions of a mass of fluid, or of a solid and a fluid, there is a pressure whose direction at any point is normal to the interface; the intensity of this pressure is its amount per unit area.

PRESTER JOHN (Priest or Presbyter John). In the middle ages it was reported by travellers that there was a Christian prince who reigned in the interior of Asia under this name, and the same story was also known to the Crusaders. Albert of Aix and Otho of Freisingen speak of him in the twelfth century; Rubruquis, in the thirteenth century, attributes the name of *Prester John* to a Nestorian prince, Ung or Ungh Khan, who had reigned in Karakorum over two Mongol tribes, and perished in a war against Genghis Khan, above half a century before the time of his journey. Other travellers of the thirteenth century also mention this personage, and Giovanni di Montecorvino, bishop of Cambalu, is said to have converted (1305) a prince of his house to Christianity. Who this Prester John was it is not easy to decide; the supposition that he was the Dalai Lama, or one of the chief priests of the Lamaites, does not agree with the position assigned to his residence by the travellers, nor does any of the etymological explanations which have been proposed seem satisfactory. The most ludicrous mistake on this subject was that made by the Portuguese in the fifteenth century, who picked up a story of a Christian prince in the interior of Africa, whose name was Ogan, and who was in fact the negus (king) of Abyssinia. In consequence of the resemblance of the names *Ogan* and *Ung Khan* they transferred the throne of Prester John from Asia to Africa, and gave the name to the Abyssinian prince.

PRESTO (Italian), quick, used in music to designate a faster rate of movement than is indicated by *allegro*. *Presto assai* denotes very quick, and *prestissimo* the highest degree of quickness.

PRESTON, a manufacturing and market town, a municipal and parliamentary borough of England, in Lancashire, 28 miles north-east of Liverpool, agreeably situated on a height above the right or north bank of the Ribble, near the head of its estuary, and on the London and North-western and other railways. It consists of ten principal and a great number of minor streets. The houses are almost all substantially built of brick, and the town is on the whole well laid out. The environs of the town exhibit much pleasing scenery, and are adorned with numerous handsome villas and public walks and parks. The ecclesiastical edifices include twelve churches, besides Roman Catholic and Dissenting chapels. Among the former Christ Church is admired for the purity of its Norman architecture; and the parish church, which has been rebuilt in the decorated style of the fourteenth century, with a spire 196 feet high, is also a fine building. Among the other places of worship should be mentioned one of the Roman Catholic chapels, which has a beautiful spire, and ranks as the most splendid place of worship in Preston. The other more important buildings are the town-hall, a handsome stone edifice in the Gothic style, erected in 1867, with a lofty clock tower; court-house, well situated, and built in the Doric style; a new infirmary, the house of correction, the custom-house, corn-exchange, new gas-offices, large and handsome market-shed, extensive barracks, workhouse, theatre, and assembly-rooms. The river is spanned by five bridges, two of them railway bridges, one of which cost £40,000. A railway station has been recently built at a cost of about £200,000. The scholastic and literary establishments include a free grammar-school; the blue-coat, commercial or middle, and various national and infant schools; the Literary and Philosophical Institution, provided with a library and museum; the Harris Institute of Literature, Art, Science and Technical Instruction (formerly the Mechanics' Institute, and now greatly enlarged); the Free Public Library and Museum, in the Grecian style (now in course of erection), &c. The town is supplied with water from reservoirs situated near Longridge, 17 or 18 miles to the north-east of Preston, capable of storing 265 millions of gallons, and formed at a cost of about £300,000. On the south side of the town are two beautiful public parks, the one 40 acres in extent, the other 12 acres, and on the north side of the town is the Moor Park, which has an area of 90 acres.

The original staple manufacture of the town was linen, which is still woven to some extent, but has been completely eclipsed by the cotton manufacture, which, first introduced in 1777, now employs a very large number of mills for spinning and weaving. There are also several steam saw-mills. Other branches of manufacture are carried on in numerous machine-shops on an extensive scale, iron and brass foundries, railway-carriage works, breweries, malt-houses, roperies, tanneries, &c. Some shipping trade is also carried on, though greatly obstructed by the condition of the Ribble. But in 1884 plans were formally approved by the municipal corporation for the deepening and the diversion of the river for a certain part of its course, and the formation of a dock of 40 acres, besides two graving docks and a timber pond of 25 acres, with the necessary approaches, basins, gates, &c., and it was intended to commence operations forthwith.

Preston dates its foundation from a very early period, and is said to have risen on the decay of Ribchester, the Roman Rigodunum, situated about 11 miles further up the river. Its name, originally Priest's-town, it owed to the number of religious houses which it contained. Its history presents few events of interest. About 600 it was a Saxon settlement; in 1323 it was taken and burned down by Robert Bruce; in 930 its first parish church was

built; in the great civil war it espoused the Royalist cause, and suffered severely during the contest, having been twice captured by the Parliamentarians, who on the latter occasion were headed by Cromwell in person; in the rebellion of 1715 it was occupied by the Jacobite forces, who erected barricades and made a brave resistance, but were ultimately obliged to surrender at discretion; in that of 1745 the Highlanders, headed by the Pretender, passed through Preston both on their march to London and on their retreat. It became a borough by prescription, but obtained the confirmation or extension of its privileges by no fewer than fourteen royal charters—the first from Henry II., and the last from Charles II. It returns two members to Parliament, and is governed by a mayor, eleven other aldermen, and 36 councillors. Pop. of municipal borough (1881), 96,537; of parliamentary borough, 93,720.

PRESTONPANS, a small town in Scotland, in the county of Haddington, near the south shore of the Firth of Forth, where it possesses a small harbour. There is a station on the North British Railway connecting it with Edinburgh, 8½ miles distant. The principal public works are those of the Preston-Grange Coal and Iron Co., a pottery, soap-works, salt-works, and a brewery. In the immediate vicinity was fought (21st Sept., 1745) the famous battle in which the Highlanders, headed by Prince Charles, signally defeated the royal troops commanded by Sir John Cope. Pop. (1881), 2573.

PRESUMPTION, in law, is the taking of a fact or proposition as true before it is shown or certainly known to be so. Presumptions are either *juris*, or *juris et de jure*. The *præsumptio juris* is a presumption established in law till the contrary be proved. Thus a person who has the possession of goods is presumed to be the owner, or a man is assumed to be innocent unless the contrary be proved. The *præsumptio juris et de jure* is that where law or custom establishes the truth of any point on a presumption that cannot be overcome by contrary evidence, as the presumption of incapacity in a minor with guardians to act without their consent. Presumptions are adopted from the necessity of arriving at some conclusion or other in most cases where the evidence is general or inconclusive. Thus where a person has disappeared and has not been heard of, the law will in general presume that he is still alive, unless after a lapse of time considerably exceeding the ordinary duration of human life; but if there be evidence of his continuous unexplained absence from home, and of the non-receipt of intelligence concerning him for a period of seven years, the presumption of life ceases.

PRETENDER. See CHARLES EDWARD STUART, and STUART (JAMES EDWARD FRANCIS).

PRÊTRES INSERMENTÉS, or RÉFRACTAIRES, in French history, the name given to those priests who, on the eve of the first revolution, refused to take the oath to be faithful to the nation, the law, and the king, and to support the constitution which should be framed by the National Assembly and accepted by the king. Most of the old prelates and priests refused to take this oath, and others, elected by the people, were at once put into their places. The non-juring clergy formed one of the most powerful means of opposing republicanism in France; they kindled the war in La Vendée; many of them in the remote provincial districts roused the people to petty revolts, in which those ecclesiastics who took the oath were driven out of the churches, hunted from their parishes with dogs, the churches often sacked, and much blood was shed. The greater number of them emigrated, and published excommunications and charges of heresy, particularly from England, against those who had submitted to the new order of things. The National Convention opposed these attacks by the severest measures. Several hundreds of the refractory clergy were put to death in the prisons of Paris on the 2d and 3d of September, 1792; Carrier drowned fifty-eight at one time at Nantes, and a law was passed condemning them *en masse*. The concordat of 1801, in which Napoleon sought to make the church a support to his power, restored the old connection with Rome.

PREVESA, a fortified town of European Turkey, in the pashalic of Janina, on the northern side of the Gulf of Arta, 18 miles south-west from Arta. Near the town are found the ruins of Actium and Nicopolis. In 1684 the Venetian admiral Morosini took from the Turks Santa Maura, Prevesa, Butrinto, Parga, Arta, and Voinitza, and thus rendered Venice mistress of the Ambracian Gulf. In 1797 these places were ceded to the French Republic, and when the latter became involved in a war with Turkey, Ali, pasha of Janina, took Prevesa by storm (1798), pillaged the city, and put to death the greater part of the male population. Prevesa again suffered by the rebellion of Ali, whose son threw himself into the citadel, and thus subjected it to a long blockade. In 1825 it suffered by an earthquake. Pop. variously estimated at from 4000 to 8000.

PRÉVOST D'EXILES, ANTOINE FRANÇOIS, a French writer, born in 1697, studied with the Jesuits, and entered the order, which, however, he soon quitted for the military service. Dissatisfied with the slowness of promotion he again joined the Jesuits, but after a short time once more returned to the career of arms, and served with reputation. Disappointed love next caused him to assume the habit of the Benedictines of St. Maur, and he retired to St. Germain des Prés, where he found consolation in study. His restless temper soon led him to separate himself from the Benedictines, and in 1729 he went to Holland. Here he published his Mémoires d'un Homme de Qualité, and afterwards went over to England. In 1734 he returned to France, and was appointed almoner and secretary to the Prince of Conti. The chancellor d'Aguesseau also selected him to superintend the Histoire générale des Voyages. As he was one day walking in the forest of Chantilly he was attacked by a stroke of apoplexy. Having been found in a state of insensibility by some peasants the public officer proceeded to open the body of the supposed deceased, when he opened his eyes; but the wound was mortal. This event occurred in 1763. Besides the works already mentioned are his Histoire de M. Cleveland, Histoire du Chevalier des Grieux et de Manon Lescaut, with several other romances, a literary journal called Pour et Contre, and numerous translations from English. His select works were published in Paris in 1783, and again in 1810–16.

PRÉVOST-PARADOL, LUCIEN ANATOLE, a French writer and member of the Academy, was born at Paris, August 8, 1829. He was educated at the Collége Bourbon and the Ecole Normale. On leaving the latter in 1851 he devoted himself to literary pursuits, and the same year his éloge on Bernardin de St. Pierre gained the prize for eloquence given by the French Academy. In 1855 he obtained the chair of French literature in the faculty of Aix, but soon resigned, and next year became one of the editors of the Journal des Débats. He maintained his connection with this paper to the last, and contributed to it a large number of articles distinguished by vigour, beauty of style, biting irony, and keen satire. As a lover of constitutional government the empire came frequently under the lash of his pen, and it was articles contributed by him to the Courrier

du Dimanche that caused the suppression of that paper in 1866. On the accession of the Ollivier ministry in 1870 he accepted office under the imperial government, and went as ambassador to the United States; but soon after his arrival put an end to his own life—his mind being, it is believed, unhinged by the news of the declaration of war by France against Prussia, and by his cold reception by the Americans, whom he unexpectedly found were more German than French in their sympathies. He wrote Études sur les Moralistes Français, Essai de l'Hist. Universelle, La France Nouvelle, Du Rôle de la Famille dans l'Éducation, &c.

PREVOST'S THEORY. See HEAT EXCHANGES.

PRÉVÔT, COURS PREVÔTALES. Several officers bore the name of *prévôt* in France previous to the revolution. The *grand prévôt de France*, with two deputies, exercised jurisdiction in the royal palace and household; the *prévôt des marchands* at Paris and Lyons was the first magistrate of the city. The *prévôt de Paris*, as governor of the *châtelet*, was the chief judicial officer, head of the knights of the town and its dependent territory, and of the *vicomté* of Paris, and was the *bailli* of the university. The *prévôts des maréchaux de France*, who were restored for a time under the name of *cours prévôtales*, were guardians of the public peace, and exercised a rather summary justice over vagabonds, robbers, gipsies, and disturbers of the public peace. The nobles, and most of the officers of government, were not amenable to their jurisdiction, which was so badly administered (for the *prévôts* were not jurists) that the chancellors L'Hôpital and D'Aguesseau restricted their authority by the ordinances of 1505 and 1731, and in 1790 it was entirely abolished. But Napoleon found that the ordinary courts were insufficient to maintain the strict control which he desired over public order. By the law of March 3, 1810, concerning prisons of state, he received the power of confining dangerous persons, without trial, in those prisons. In 1800 the foundation had already been laid for the erection of special tribunals, which the new criminal organization of 1808 confirmed, with new developments. In these special tribunals the president of the court of assizes, with four councillors and three military men, were to judge vagrants for all manner of crimes; and in case of rebellion, armed smuggling, counterfeiting, and murder, by numbers, the trial was to be without jury and in a summary form. The imperial decree of April 6, 1809, added to the above specified acts that of having borne arms against Napoleon since September 1, 1804. For the trial of smugglers, by an imperial decree of October 18, 1810, *cours de douanes* were established in thirty-six cities, and *cours prévôtales des douanes* in eight cities; the latter had a *grand-prévôt* for president, with eight assistant judges, and in cases of armed smuggling had original jurisdiction, and proceeded without jury. All these extraordinary tribunals, together with the military commissions, were abolished by the charter of 1814 (art. 63), with a proviso for the restoration of the *cours prévôtales*, should it be found necessary. By the law of December 20, 1815, the special criminal courts were re-established for two years, under the name of *cours prévôtales*. One of these courts was erected in each department, consisting of a jurist as president, a military officer as *prévôt*, and four members of the court of the first instance in the district. Their jurisdiction resembled that of the special criminal courts constituted in 1808, and their procedure was exactly the same. They were not renewed, and therefore tacitly expired in 1818.

PRIAM, the last King of Troy, was the son of Laomedon and Strymo or Placia, and called, in his earlier years, *Podarces* (the swift-footed); but when Hercules took Troy, and permitted Hesione to ransom one of the prisoners at her own price, she selected her brother Podarces, and gave her veil for him. On this account he was ever after called *Priam* (the Ransomed). When a youth he marched with the Phrygians against the Amazons, and went as ambassador to the Thracians. After the death of his father he reigned in Troy. By his first wife, Arisbe, daughter of Merops, he had Æsacus. He afterwards gave Arisbe to Hyrtacus, and married Hecuba, by whom he had, according to Homer, nineteen children, among whom Hector, Paris, Creusa, Laodice, Polyxena, Cassandra, Deiphobus, Helenus, Pammon, Polites, Antiphus, Hipponous, Polydorus, and Troilus were the most distinguished. By four concubines he also had thirty sons and four daughters. His name has been rendered famous by the tragical fate of himself and his family, brought on by his blind love for his son Paris; for when he was extremely old the Greeks demanded of him the restoration of Helen, who had been carried away by Paris, and on his refusal to give her up they made war against Troy, took and destroyed the city, after a siege of ten years, his son Hector having already fallen before his eyes. When the Greeks entered the city the old man armed himself to seek death in the midst of the enemy; but the prayers of Hecuba prevailed upon him to take shelter at the altar of Zeus. Here he saw his son Polites fall by the hand of Pyrrhus; and unable to contain himself, he hurled his javelin at the youthful warrior, who dragged the old man by the hair to the altar, and plunged a sword into his breast.

PRIAPUS, originally a god of the fields in Lampsacus, a town of Mysia, situated in a rich wine country. Aphroditē bore him to Dionysus when the latter was returning from India, but was unwilling to acknowledge him on account of his deformity. Others give him a different origin; but he was always god of the fields, the protector of gardens, bees, goats, and sheep. The earlier Greek poets, such as Homer and Hesiod, do not mention this divinity, and it was only in later times that he was honoured with divine worship. He was represented with horns and goat's ears, and large sexual parts, having in his lap all kinds of fruits; in his hand he held a sickle, and usually a horn of plenty. His worship spread from Lampsacus over Greece to Rome. He is considered by mythologists to represent the productive power of nature.

PRICE. See VALUE.

PRICE, RICHARD, a distinguished mathematician and statistical writer. He was born at Tynton, in Glamorganshire, in 1723, and was educated at Talgrath, in his native county. On the death of his father, an intolerant Dissenting divine, who strongly disliked his son's liberality of sentiment, Richard found himself so poorly provided for that, wishing to complete his education in London, he was compelled to do most of the journey on foot. He obtained admission to a Presbyterian academy in London, and after four years' study engaged himself as chaplain to a Mr. Streatfield, with whom he lived thirteen years, and who on his death left him some property. By the death of an uncle in 1757 his circumstances were further improved, and he was enabled to carry out a matrimonial engagement he had formed with a Miss Blundell. He then became pastor of a Nonconformist congregation, of Arian or semi-Arian principles, at Hackney, where he continued as long as he lived. He commenced his literary career in 1758 by his Review of the principal Difficulties in Morals (8vo), which was followed by Four Dissertations on the Importance of Christianity, the Nature of Historical Evidence, and Miracles, &c. (1767, 8vo).

In 1769 he received the diploma of D.D. from the University of Glasgow. In 1771 appeared his Observations on Reversionary Payments and Annuities (8vo), which established his character as a mathematical calculator. This was followed by his compilation and publication of the celebrated Northampton Mortality Tables, and other valuable works relating to life assurance and annuities. He next published an Appeal to the Public on the Subject of the National Debt; and during the contest with the North American colonies advocated their cause in Observations on Civil Liberty (1776, 8vo), Additional Observations, and a Supplement. These tracts provoked the animadversions of a number of writers on the opposite side of the question, and exposed him to some obloquy, but they also procured him a vote of thanks from the corporation of London presented in a gold box. He engaged in an epistolary correspondence with his friend Dr. Joseph Priestley, on the subjects of materialism and necessity, the substance of which was laid before the public in an octavo volume in 1778. When Pitt became prime-minister he consulted Dr. Price in his schemes for the reduction of the national debt, and the establishment of the sinking fund was the result of his recommendation. At the commencement of the French revolution, in a sermon (published in 1789) On the Love of Country, he warmly expressed his delight at the emancipation of the French people. This discourse produced Burke's Reflections, in which Dr. Price was severely treated. He died April 19, 1791. Besides many papers in the Transactions of the Royal Society, of which he was a fellow, he published Sermons on the Christian doctrine, as received by the different Denominations of Christians (8vo), and several single sermons and political pamphlets.

PRICHARD, James Cowles, a distinguished ethnologist, was born at Ross, in Herefordshire, in 1785, or a year later according to other authorities, studied medicine, and took the degree of M.D. at Edinburgh. On this occasion he chose for his thesis the physical history of mankind, a subject which he afterwards made his peculiar study. He commenced practice as a medical man at Bristol, and in 1810 received the appointment of physician to the Clifton Dispensary and St. Peter's Hospital. In 1813 he published his great work, Researches into the Physical History of Mankind, which, originally issued in one volume, was in the third edition, completed in 1849, extended to five. It is regarded as the standard of ethnological treatises. In 1843 appeared his Natural History of Man, which has been translated into both French and German. He also produced several minor works on the subject of ethnology, besides numerous papers contributed to the British Association and other learned societies. In his own profession the diseases of the nervous system and the various phases of insanity engaged a large share of his attention, and he published treatises on the diseases of the Nervous System; on Insanity; and on the Different Forms of Insanity in relation to Jurisprudence. In 1845 he was appointed one of the commissioners of lunacy, and in consequence removed from Bristol to London, where he continued to reside to the close of his life. He died on 22d December, 1848.

PRICKLY PEAR, *Opuntia vulgaris*, natural order Cactaceæ, the Indian fig. The Opuntia is a fleshy and succulent plant, destitute of leaves, covered with *fasciculi* of stellate spines, and consisting of flattened joints inserted upon each other. The flowers are pretty large, yellow, having numerous petals and stamens. They are succeeded by a purplish and edible pyriform fruit, which is sometimes imported into the British market. It is a native of the tropical parts of America, whence it has been introduced into Europe, Mauritius, Arabia, Syria, and China.

PRIDEAUX, Humphrey, a learned English divine, born at Padstow, in Cornwall, in 1648, was educated at Oxford, and while at the university published the ancient inscriptions from the Arundel marbles, under the title of Marmora Oxoniensia. Lord-chancellor Finch, earl of Nottingham, gave him a prebend in Norwich cathedral, and Lord North bestowed on him the rectory of Bladen, which, on taking the degree of D.D., he exchanged for the benefice of Soham, in Norfolk. He was subsequently promoted to the archdeaconry of Suffolk, and in 1702 made Dean of Norwich. His death took place November 1, 1724. Besides his great work, entitled the Old and New Testament connected in the History of the Jews and neighbouring Nations, of which there are many editions, he was the author of the Life of Mohammed (8vo), the Original and Right of Tithes (8vo), Ecclesiastical Tracts (8vo), &c.

PRIEGO, a town in Spain, Andalusia, in a beautiful plain watered by the Salado, 36 miles south-east of Cordova. It is well built, and has an ancient castle, built by the Romans, and enlarged by the Moors; an old Gothic church, three suppressed convents, a nunnery, and a foundling hospital. Priego was once famous for its silk manufactures, now reduced to insignificance. Miguel Lopez, the sculptor, was born here. Pop. 15,674.

PRIEST (Hebrew, *cōhēn;* Greek, *hiereus;* Latin, *sacerdos*). The English word *priest*, like the German *priester* and the French *prêtre*, is simply a contracted form of the word *presbyter*. (See Presbyterianism.) In its most general signification the title was applied to those officers who were called by choice or birth to inculcate and expound religious dogmas, to perform religious rites, and to fulfil in other ways the functions of a mediator between the worshippers and the Being worshipped. Among the ancient pagan nations all that was dignified and venerable, that deserved respect and obedience, that stood nearer to the Divinity than the common mass of mortals, was associated with the idea of the priestly office. The patriarch of the primitive world was at once the king and the priest of his family; and when the state was developed from the family the royal and priestly dignity still continued for a long time to be united in the same person. But these offices became separated in those states of antiquity which owed their existence to the ascendency of single heroes or conquering tribes; and by the side of the regal dignity and sovereignty a sacerdotal order, which in some countries was elective, in others hereditary, grew up, and by the reputation of superior wisdom and secret communion with the gods (whence the priests were also honoured as magicians and physicians), inspired the mind with awe. In the states of Western Asia, in Egypt, Greece, and Rome, the priests were therefore public councillors and instruments of government. Their original office was to bring down divine things to the conception of men, and to solemnize the public worship of the gods by sacrifices, prayers, and religious pomp (mysteries). Instruction and the interpretation of symbolical doctrines ceased to be a part of their office when the mythical religious system came to an end; and when the poets, rhetoricians, and philosophers assumed the office of interpreters of the myths, the sole business of the priests became the performance of the religious rites. In sacred history the patriarchal order furnishes an example of the family priesthood. Abraham, Isaac, and Jacob perform priestly acts, and 'draw near to the Lord' (Gen. xii. 8; xviii. 23; xxvi. 25; xxxiii. 20), as also does Job (i. 5). Instances of the union of the priestly and princely dignity are found in Melchisedek and

Jethro; the Arab sheikh to this hour unites in his person the civil and religious headship.

The Mosaic priesthood was the inheritance of the sons of Aaron, of the tribe of Levi. The order of the priests stood between the high-priest on the one hand and the Levites on the other. (See HIGH-PRIEST and LEVITES.) The ceremony of their consecration is described in Exodus xxiv. and Leviticus viii. The dress they wore during their ministrations consisted of linen drawers, with a close-fitting cassock also of linen, white, but with a raised diamond or chess-board pattern on it. The cassock, which descended nearly to the feet, was gathered round the body with a girdle of needle-work, into which blue, purple, and scarlet were intermingled with white, and worked in the form of flowers. On their heads they wore caps also of fine linen, and in the form of a cup-shaped flower. In all their ministrations the priests were barefooted, from the acknowledged impropriety of entering sacred places with shoes on the feet—a custom which prevails in the East at the present day. Before they entered the tabernacle they washed their hands and feet, and during the time of their ministration they partook of no wine or strong drink. They were not to mourn for the dead except in the case of a father, mother, son, daughter, brother, or sister (if a virgin). They were forbidden to marry an unchaste or foreign woman, one who had been divorced, or the widow of any but a priest. Their chief duties were to watch over the fire on the altar of burnt-offerings, and to keep it burning continually both by day and night after it had been first kindled from heaven. They fed the golden lamp outside the veil with oil. They had to offer a lamb morning and evening, and two lambs on the Sabbath, each accompanied with a meat-offering and a drink-offering at the door of the tabernacle. These were fixed duties which never varied, but their chief function was their being always at their post to do the priest's office for any guilty, penitent, rejoicing, or thankful Israelite. The worshipper might come at any hour. As the people started on each day's march, during the wanderings of the Israelites, the priests sounded an alarm with long silver trumpets. They blessed the people at every solemn meeting and at every regular daily sacrifice. They had, further, the task of instructing the people in the law of God, and were the guardians thereof. They blessed the army before the beginning of an action, and some of them seem to have taken part in the fighting. Functions such as these necessarily took up the greater part of their time, and accordingly a distinct provision had to be made for them. This consisted of one-tenth of the tithes which the people paid to the Levites, or 1 per cent. of the whole produce of the country; of a special tithe every third year; of the redemption-money, paid at the fixed rate of 5 shekels a head for the first-born of man or beast; of the redemption-money in like manner paid for men or things specially dedicated to the Lord; of spoil, cattle, captives, &c., taken in war; of the show-bread, the flesh of the burnt-offerings, peace-offerings, trespass offerings, and in particular the heave-shoulder and the wave-breast; of an undefined amount of the first-fruits of corn, wine, and oil. On their settlement in Canaan the priestly order had thirteen cities allotted to them, with pastures for their flocks. These provisions were obviously intended to secure the religion of the Israelites from the dangers of a caste of pauper priests, needy and dependent; but the priests were, on the other hand, as far as possible removed from the condition of a wealthy order. The earliest historical trace of any division of the priesthood, and corresponding cycle of services, belongs to the time of David. The order was then divided into twenty-four courses, each of which was to serve in rotation for one week, while the further assignment of special services during the week was determined by lot. To the descendants of Ithamar, son of Aaron, eight courses only were assigned, but to those of his brother Eleazar sixteen were allotted. The division thus instituted was confirmed by Solomon, and continued to be recognized as the typical number of the priesthood. On the return from the captivity there were found but four courses out of the twenty-four, each containing in round numbers about 1000. Out of these the twenty-four courses were reconstituted, bearing the same names as before, and so continued till the destruction of Jerusalem.

In the New Testament the name given to the ministers of the Christian religion is *presbuteros* (elder), which does not imply the sacerdotal character, as does the term *hiereus;* and it is held by the majority of Protestants that the idea of a consecrated priesthood invested with sacerdotal functions is repugnant to Christianity. The apostles claimed no priestly functions; their language is always pastoral; a ministry was recognized and instituted, but nowhere a priesthood; that was concentrated in Christ. Those Christians, however, like the Roman Catholics, Greeks, &c., who look upon the eucharist as a sacrifice, have a system of priesthood. The priest is the ordinary minister of the eucharist, of baptism, penance, and extreme unction; and by the Romish Church he is regarded as the official witness of the celebration of marriage, the contracting parties being considered by modern divines to be themselves its ministers. To him is officially intrusted the instruction of the people and the direction of their spiritual affairs. The order of priesthood is conferred by a bishop, ordinarily assisted by two or more priests, all of whom impose hands on the candidate for holy orders. The priests of the Church of Rome are bound to a life of celibacy. In the Greek Church the priesthood may be conferred on married men, but no one is allowed to marry after ordination, or marry a second time should his first wife die. In the Anglican as well as other reformed Episcopal churches the term priest is used to designate the second order of clergy, bishops ranking first. It is the duty of the priest to celebrate the sacrament of the Lord's supper; to pronounce the forms of absolution in the morning and evening prayer, in the communion service, and in the office for the visitation of the sick; and to preach, which office is, however, extended occasionally by special license to deacons.

As it is considered by many that the Jewish priesthood was modelled in some measure upon that of Egypt, it may be serviceable to note several facts connected with the latter. The sacerdotal order in Egypt constituted the highest of the four principal castes into which the kingdom was divided. The priests were the principal confidential and responsible advisers of the king; they assisted him in the performance of his public duties, and explained to him from the sacred books those lessons which were laid down for his conduct. They were endowed with lands by the kings, and seem to have had a public maintenance besides. Each deity had several priests and a high-priest; the minor priests were divided into various grades having distinct offices, as well as the scribes and priests of the kings. The same office descended from father to son, but was sometimes changed. They enjoyed important privileges, which were extended to their whole family. They were exempt from taxes. Wine was allowed to them in strict moderation, and, as well as animal food of all kinds, was abstained from during their numerous and protracted fasts. Each grade of the priests was distinguished by its peculiar costume. The high-

priests, who, among other official duties, anointed the king, wore a mantle made of an entire leopard-skin, as did the monarch when engaged in priestly duties. The under-dresses of priests of all orders were made of linen, and they were not allowed to wear woollen in a temple. Besides their religious functions, the priests fulfilled the offices of judges and legislators, and the laws forming part of their sacred books could only be administered by members of that order. See BRAHMAN, DRUID, MAGI.

PRIESTLEY, JOSEPH, an eminent philosopher and divine, was born 13th March, 1733 (o.s.), at Fieldhead, near Leeds. His father was a clothier, of the Calvinistic persuasion, in which he was also himself brought up under the protection of an aunt, who, after he had attained a respectable degree of classical acquirement in several schools of the neighbourhood, finally placed him at the Dissenting academy at Daventry, with a view to the ministry. He spent three years at this school, when he became acquainted with the writings of Dr. Hartley, which made a great impression upon his mind; and he was gradually led into a partiality for Arianism. On quitting the academy in 1755 he accepted an invitation to become minister of Needham Market, in Suffolk, where he had to live as best he could on an average salary of £30 a year. After a residence of three years he undertook the charge of a congregation at Nantwich, in Cheshire, to which he joined a school. Here his reputation increased, and in 1761 he was invited by the trustees of the Dissenting academy at Warrington to occupy the post of tutor of languages and belles letters under Dr. Aiken. At Warrington his political opinions were manifested in an Essay on Government. He published an Essay on a Course of Liberal Education, and his useful Chart of Biography. He also prepared some school-books, and even wrote some poetry. Here he married a Miss Wilkinson, a lady of great talent and amiability. A visit to London having introduced him to Drs. Franklin, Watson, and Price, he was encouraged to compose a History of Electricity, which first appeared in 1767, and procured him an admission into the Royal Society; he had previously obtained the title of Doctor of Laws from the University of Edinburgh. In the same year he accepted an invitation to become minister, at a salary of £100 a year, of the Mill Hill chapel at Leeds, where his religious opinions became decidedly Socinian. At Leeds, owing to his dwelling being near a brewery, his attention was first drawn to the properties of 'fixed air' (carbonic acid gas); and about this time he completed his History and Present State of Discoveries relating to Vision, Light, and Colours. In 1771 he agreed to accompany Captain Cook on his second voyage in the capacity of astronomer, but he had the deep mortification of having his appointment cancelled, as the Board of Longitude objected to his theology. After a residence of six years at Leeds he accepted an invitation from the Earl of Shelburne, afterwards Marquis of Lansdowne, to reside with him as a companion in the nominal capacity of librarian, with a salary of £250. While forming a part of the establishment of this nobleman, he occupied himself in scientific pursuits, and in 1773 gave to the Philosophical Transactions a paper on the different kinds of air, which obtained the prize of Copley's gold medal. In 1774 he discovered oxygen or 'dephlogisticated air,' as he called it, a result which was quickly followed by other important discoveries, such as nitrous gas, nitrous oxide gas, sulphurous oxide gas, fluoric acid gas, muriatic gas, ammoniacal gas, &c., as well as the pneumatic apparatus now in common use. By these exploits he may be said to have been almost the first to render chemistry a precise science. He travelled through France, Holland, Belgium, and Germany, and made many new friends. The Parisian chemists and mathematicians told him he was the only philosopher of standing known to them who believed in Christianity. In 1775 he published his Examination of the Doctrine of Common Sense, as held by Drs. Reid, Beattie, and Oswald, and soon after published the treatise of Hartley. He had already declared himself a believer in the doctrine of philosophical necessity, and in a dissertation annexed to his edition of Hartley expressed some doubts of the immateriality of the sentient principle in man. This doctrine he still more forcibly supported in his Disquisitions on Matter and Spirit (1777); and the obloquy which these works brought on him producing a coolness in his patron, the connection was dissolved in 1780, the doctor retaining an annuity of £150 per annum by original agreement. He next removed to Birmingham, where he became once more minister of a Dissenting congregation, and occupied himself on his History of the Corruptions of Christianity, and History of the Early Opinions concerning Jesus Christ. In connection with Dr. Darwin, Messrs. Watt, Boulton, Wedgwood, and other famous men he founded the now celebrated Lunar Society, which rendered Birmingham for the time of its existence almost the intellectual centre of England. His Familiar Letter to the Inhabitants of Birmingham was written in support of the claims of the Dissenters for a repeal of the test acts. The era of the French revolution added to the usual animosity of theological dispute. The anniversary of the capture of the Bastille being celebrated at Birmingham, a mob assembled, and although Dr. Priestley was not present, proceeded to his house, which, with his library, manuscripts, and apparatus, fell a prey to the flames. The outrage was countenanced by too many exercising both lay and clerical influence, and the legal compensation which he obtained fell short of his real losses by about £2000, according to his own estimate. On 1st August, 1874, Birmingham made some amends for the wrong done to her greatest citizen, by the erection of a marble statue of him in front of the town-hall. On quitting Birmingham he was chosen to succeed his friend Dr. Price as president of the Dissenting college at Hackney, where he remained some time in the cultivation of his scientific pursuits, until finally goaded by party enmity to seek an asylum in the United States, which he reached in 1794, and took up his residence at Northumberland, in Pennsylvania. In America he dedicated his whole time to his accustomed pursuits, until a severe illness laid the foundation of a debility in his digestive organs; and a gradual decay followed, which terminated his existence, February 6, 1804, in his seventy-first year. He had composed not long before his Jesus and Socrates Compared. Dr. Priestley was an ardent controversialist, chiefly in consequence of extreme simplicity and openness of character; but no man felt less animosity towards his opponents than he did, and many who entertained the strongest antipathy to his opinions were converted into friends by his gentleness and urbanity in personal intercourse. As a man of science he stands high in the walk of invention and discovery, and to few has pneumatic chemistry been so much indebted. On his own admission his researches in his favourite science were superficial, and his great discoveries to a considerable extent accidental. Had he limited his field of study to a tenth of its actual dimensions, and devoted all his energies to the exploration of that smaller area, his work would probably have still seemed faulty in many ways to the exact critics of our age. Distributing his powers so widely as he did the faults were necessarily numerous. But this

should detract nothing from the honour due to the earnest pioneer. As a metaphysician his elucidation of Hartley's theory of association, his works upon philosophical necessity and upon materialism, will always insure attention. As a theologian Dr. Priestley, who followed his convictions wherever they led him, passed through all changes, from Calvinism to a Unitarian system in some measure his own; but to the last remained a zealous opposer of infidelity. Of his theological and controversial productions, those most generally esteemed are his Institutes of Natural and Revealed Religion, and Letters to a Philosophical Unbeliever. He also wrote many works of practical divinity. His works amount to about seventy volumes or tracts in octavo. See his Life, by himself and his son.

PRILUKI, or PRILOUKY, a town of Russia, in the government of Poltava and 120 miles north-west of the city of that name, situated on the Udaia. It is a poorly-built and dirty town, but has three important annual fairs, and a considerable trade in corn, cattle, saltpetre, tobacco, and brandy. Pop. 12,878.

PRIM, JUAN, MARQUIS DE LOS CASTILLEJOS, COUNT DE REUSS, Field-marshal and Grandee of Spain, son of Pablo Prim, a colonel of infantry, was born at Reuss, in Catalonia, 6th December, 1814. He was destined for the law, but on the outbreak of the civil war which followed the death of Ferdinand VII. (29th September, 1833) he joined the volunteers who had taken up arms in the cause of the infant queen Isabella. In a short time his skill and valour obtained for him the command of a company, and in 1837 he was appointed a colonel in the regular army. When the civil war terminated in 1839 Prim turned his attention to politics, became an active deputy in several parliaments, and organized several political clubs. When Queen Maria Christina quitted Spain he allied himself with the Progresista party, and vigorously opposed Espartero, who had assumed the regency, 8th May, 1841. Taking part in the insurrection at Saragoza in 1842, but being unsuccessful, he was obliged to take refuge in France, where he attached himself to Queen Maria Christina. The amnesty of the following year permitted his return, and he was chosen deputy to the Cortes by Barcelona. In the May of that year he placed himself at the head of an insurrectionary movement against Espartero at Reuss, and on being dislodged from that town fled to Barcelona, where he succeeded in raising the inhabitants in his favour. On the downfall of the Espartero ministry Prim was appointed by the queen a brigadier-general. Shortly afterwards he was created Count de Reuss, and was intrusted with the governorship of Madrid (1843). On the occasion of a democratic rising at Barcelona he was sent to restore order, but with little success. The revolt soon began to attain wide proportions, and Prim was accused of dilatoriness and dismissed from his command. Irritated at this disgrace, he joined a conspiracy whose objects were the overthrow of the government and the assassination of Narvaez, president of the council. In November, 1844, he was brought to trial for his share in the baulked conspiracy, was convicted and sentenced to six years' seclusion in a fortress, a sentence which was revoked by the queen in January, 1845. For several years he lived a sort of retired life, but in 1853 he offered his services to the sultan, received a command, and contributed to the early successes of the Turks against the Russians on the Danube. On his return to Spain he found O'Donnell and the chiefs of the liberal union at the head of affairs, and eagerly leagued himself with them. In 1857 he was promoted to the rank of lieutenant-general, and in 1858 was raised to the senate. In the following year, war having broken out between Spain and Marocco, Prim was appointed to the command of the reserve. His bravery and presence of mind at Castillejo on the New-Year's day of 1860 turned what might have been a total rout into a victory for Spain, and he was rewarded with the title of Marquis of Castillejos. The decisive defeat of the Moors at Guad-el-Ras on the 23d March led to a treaty of peace. About the end of 1861 he was appointed to command the Spanish contingent, which, along with others from England and France, was sent out to Mexico to enforce the claims of indemnity which the subjects of these states had against that country, but along with the English he withdrew his forces when it became apparent that the French were determined to found an empire there. In January, 1866, he headed a military uprising against the government of O'Donnell; but the insurrection was speedily suppressed, and he, with many of his followers, was compelled to take refuge in Portugal. Soon afterwards he came to London, where he lived for some time in comparative seclusion. The movement headed by Serrano and Topete to drive Queen Isabella from the throne had his energetic support. He returned to Spain, and materially contributed to the success of his party. On the dethronement of the queen in September, 1869, he was appointed minister of war, and exerted himself to find a suitable candidate for the Spanish crown. This was at last found in the person of Amadeo, duke of Aosta, second son of the King of Italy. On the evening of the 28th December, 1870, Marshal Prim was shot by assassins as he was proceeding in his carriage from the Cortes to the ministry of war; and on the 30th, the day when the young king landed at Carthagena, the veteran soldier and statesman died of his wounds.

PRIMAGE is the allowance made by shippers to the master of a vessel, or more commonly to the owner or charterer, for the trouble of loading and unloading cargo. It is usually combined in the bill of lading with average (see AVERAGE), both being estimated at a certain rate per cent. on the amount of freight.

PRIMATE, in the early Christian Church the title assumed by the bishop of the capital of a province, and hence equivalent to metropolitan. In Africa the title belonged to the bishop who had been longest ordained. In other parts of Christendom an attempt was made to distinguish between primates and metropolitans as early as the ninth or tenth century, for one of the capitularies of the early French kings ordains that no metropolitan shall assume the title of primate unless he has a just claim to that honour; and in the eleventh century the popes expressly reserved the title only for the leading metropolitans in different countries, and endeavoured to subordinate the other metropolitans to them. The resistance to this arrangement was, however, so general and emphatic that the dignity of primate remained little more than a nominal one, entitling the holder of it merely to precedence on public occasions. In France the Archbishop of Lyons was appointed primate of the Gauls by Gregory VII. in 1079. In the German Empire the Archbishop of Salzburg was primate. In Hungary the primacy belongs to the Archbishop of Gran (in Presburg); in Spain to that of Toledo. In Poland the primate was an important political functionary. The office belonged of right to the Papal legate, who was president of the senate and censor of the king. He governed the state during an interregnum, had a court, guards, and a marshal of the palace, and in general enjoyed the highest privileges. In the Church of England both the archbishops still retain the title of primate, the Archbishop of Canterbury being dis-

tinguished as the primate of all England and the Archbishop of York as the primate of England. In the Protestant Episcopal Church of Ireland the Archbishop of Armagh is primate as formerly when the church was established.

PRIMATES, the name given by Linnæus to his highest order or group of the Mammalia, which included the Bats (*Cheiroptera*), the Quadrumana or Apes, Monkeys, Lemurs, and Man (*Bimana*). More recently the name Primates (as explained in the articles LEMUR, MONKEY, &c.) has been used to include the orders Bimana and Quadrumana only, thus placing Man, Monkeys, Apes, and Lemurs in one great division characterized by a certain amount of close structural resemblance. The Linnæan order Primates included mammals possessing nails or *unguiculate* forms, with 'front teeth (*cutters*), 4; laniaries, 1.'

PRIMATICCIO, FRANCESCO, a painter of the Bolognese school, born at Bologna in 1490, received his first instruction from Innocenzo da Immola, and completed his studies under Giulio Romano. In connection with several of the pupils of the latter he painted the Palazzo del Tè, in Mantua, from Giulio's designs. Through the recommendation of Frederick, duke of Mantua, Primaticcio was taken into the service of Francis I. of France in 1531. His arrival and residence in France makes an epoch in French art. To his influence were owing not only numerous paintings in fresco and works in stucco which the king caused to be executed, but several branches of painting, as, for instance, enamel painting, and designs for tapestry, were carried to great perfection through his exertions. Francis sent him to Italy to purchase antique statues, of which he made a respectable collection, and caused numerous casts to be executed. On the death of Rosso, the royal painter, Primaticcio succeeded him in his post, and Francis II. appointed him in 1559 superintendent of the royal buildings. He furnished the designs of several architectural works, among them of the tombs of Francis I. and Henry II. His works at Fontainebleau, however, gained him more reputation. He was assisted in his labours by several of his countrymen, of whom Niccolo del Abbate was the most distinguished. Primaticcio died in 1570. The works which he executed in France are nobler and freer, in point of design, than those which he executed in Giulio's school. In his great works he often violated nature.

PRIME, in the Roman Catholic Church one of the canonical hours, the first of those belonging to the day as opposed to those of the night, and also the service in the breviary which falls to be performed at that time. The name of prime is derived from the Latin *prima* (that is, *prima hora*, first hour), because prime begins with sunrise, or rather the first hour of the day according to the eastern mode of reckoning, namely, 6 o'clock. The service of prime is by some said to be in commemoration of our Lord's appearance before Pontius Pilate, and by others of his resurrection. In the ritual of the English Church some portions of the service of prime are incorporated with that of matins.

PRIME CONDUCTOR, that part of an electric machine from which sparks are usually taken. In the ordinary plate electric machine it is an insulated body, which gathers positive electricity from the rubbed glass plate by means of a row of points.

PRIME MINISTER, or PREMIER. See MINISTER.

PRIME NUMBER, a number which can be divided exactly by no number except itself and unity. See NUMBERS (THEORY OF).

PRIMING, the entrance of water spray along with steam into the cylinder of an engine. It always causes great annoyance. The use of muddy water, insufficient steam-room, carelessly constructed flues and pipes, &c., in the boiler, give rise to priming. Superheating the steam is one remedy.

PRIMOGENITURE, the right of the eldest son and those who derive through him to succeed to the property of the ancestor. This right, though in a modified sense, seems anciently to have prevailed only among the Jews. The first-born in the patriarchal ages had a superiority over his brethren, and in the absence of the father was priest of the family. Among the Jews he had a double portion of the inheritance; in the same manner as by the laws of Henry I. in England the eldest son had the capital fee or principal feud of his father's possessions, and no other pre-eminence, and as the eldest daughter had the principal mansion when the estate descended in coparcenary. The 'insolent prerogative of primogeniture,' as Gibbon denominates it, was unknown among the Romans; the two sexes were placed on a just level; all the sons and all the daughters were entitled to an equal portion of the patrimonial estate. The Greeks, the Britons, the Saxons, the Danes, &c., divided the lands equally, some among all the children at large, some among the males only. The equal division of the patrimonial estate among the children is certainly the most obvious and natural way. When the emperors began to create honorary feuds or titles of nobility it was found necessary, in order to preserve their dignity, to make them impartible, and, in consequence, descendible to the eldest son alone. This example was further enforced by the inconveniences that attended the splitting of estates, namely, the division of the military services, the multitudes of infant tenants incapable of performing any duty, the consequent weakening of the strength of the kingdom, and the inducing younger sons to take up with the business and idleness of a country life instead of being serviceable to themselves and the public by engaging in mercantile, military, civil, or ecclesiastical employments. These reasons occasioned an almost total change in the nature of feudal inheritances; so that the eldest son began, universally, to succeed to the whole of the lands in all military tenures.

In this condition the feudal constitution was established in England by William the Conqueror. Before the conquest the descent of lands was to all the sons alike. Socage estates in England frequently descended to all the sons equally till the time of Henry III., when, in imitation of lands in chivalry, they had almost entirely fallen into the right of succession by primogeniture, except in Kent, where they gloried in the preservation of their ancient gavelkind tenure, of which a principal branch was the joint inheritance of all the sons, and except in some particular manors and townships, where their local customs continued the descent sometimes to all, sometimes to the youngest son only, or in other more singular methods of succession. The right of primogeniture, which calls the eldest born to the crown, was not introduced into France till very late; it was unknown to the first and second race of kings. The four sons of Clovis shared the kingdom equally among themselves. Those of Louis le Debonnaire did the same; and it was not till the race of Hugh Capet ascended the throne that the prerogative of succession to the crown was appropriated to the first-born. The right of primogeniture is now abolished in France and Belgium, but it prevails in some degree in most other nations of Europe. The rule operates as follows:—When a person dies intestate, leaving real estate, his eldest son is entitled by law to the whole; if the other brothers and sisters are not provided for out of the personality they are left destitute. If the eldest son is dead, but has left an eldest son, the latter succeeds to the whole of the property. If the whole male line is exhausted then

the daughters succeed—not in the same way, however, but jointly, except in the case of the crown, to which the eldest succeeds. In the United States no distinction of age or sex is made in the descent of estates to lineal descendants. Though primogeniture and the preference of males are now thus universally given up in that country, yet in some states they remained in full force, and in others modifications of them continued for a long period. See LAND (PROPERTY IN).

PRIMROSE (*Primula;* natural order Primulaceæ), a genus of beautiful low Alpine plants. Some are among the earliest flowers in spring, as the common primrose, the oxlip, and cowslip; and several are cultivated in gardens as ornamental plants. Their roots are perennial; the leaves almost always radical; and the flowers supported on a naked stem, and usually disposed in a sort of umbel. The calyx is tubular; the corolla funnel-shaped, and divided at the summit into five equal lobes; the stamens five in number; the style single; and the capsule oval, one-celled, and containing numerous seeds attached to a central placenta. The varieties of the common primrose (*P. vulgaris*) which have arisen from cultivation are very numerous. The *P. auricula*, a native of the Alpine regions of Italy, Switzerland, and Germany, is also a well-known favourite with the florist; and the Chinese primrose (*P. Sinensis*) is a favourite greenhouse and window plant.

PRIMULACEÆ, or PRIMWORTS, a natural order of gamopetalous exogens, consisting of annual and herbaceous, almost shrubby plants, with usually radical, but sometimes whorled and opposite or alternate leaves; flowers on radical scapes and in umbels, or variously arranged in the axils of the leaves; regular persistent five-cleft calyx, inferior or half-superior; hypogynous, regular corolla, with stamens equal to the number of its segments inserted upon it; one style and capitate stigma; and a capsule opening with valves and containing numerous peltate seeds. Many cases of anomalous structure occur in the order. The species are common in the northern and colder parts of the globe, sometimes growing among the snows of lofty mountains. They are rare within the tropics, occurring only on the sea-shore or elevated heights. They possess few economical properties; but the early and modest appearance of the primrose and cowslip in our fields and the gay appearance of others in our gardens make them general favourites.

PRIMUM MOBILE, in the Ptolemaic astronomy, the ninth or highest sphere of the heavens, whose centre is that of the world, and in comparison of which the earth is but a point. This the ancients supposed to contain all other spheres within it, and to give motion to them, turning itself, and all of them, quite round in twenty-four hours.

PRINCE (Latin, *princeps*, from *primus*, first, and *capio*, I take), literally one who holds the first place. In ancient Rome the title of *princeps senatus* was given to the leading senator, the one whose name was first inscribed on the album or list, and who had the right to record his vote first. This rank was conferred by the censors, and was a highly coveted honour. From the time of Augustus the title was always assumed by the emperors, whence arose the custom of bestowing it generally on the heads of states. The title of *princeps juventutis* was one granted under the Roman Republic to one of the noblest members of the equestrian order, but since it was bestowed by the equites on Caius and Lucius Cæsar, grandsons of Augustus, always conferred on the probable successor to the imperial seat. To this may be ascribed the origin of the practice of speaking of the sons of sovereigns by that title. In modern times the title of prince (or princess) is given to all sovereigns generally, as well as to their sons and daughters and their nearest relations. In England the title is also applied, in strict heraldic language, as a mode of address to dukes, marquises, and earls, but it is not generally so used. In Germany there is a class of sovereigns, ranking next below the dukes, who bear the title of prince (*Fürst*) as a specific designation. The members of royal families are there called *Prinzen* instead of *Fürsten*, to distinguish them from the class to whom the latter title more peculiarly belongs. On the Continent there are many ancient families not immediately connected with any reigning house (that is, not princes of the blood) who bear the title of prince, and in France several princes of this nature were created by the first Napoleon. In England the only case in which the title is a territorial one is that of the Prince of Wales.

PRINCE EDWARD ISLAND, a province in the Dominion of Canada, in the south of the Gulf of St. Lawrence, and east of Cape Breton; lat. 45° 56′ to 47° 7′ N.; lon. 62° to 64° 27′ W.; washed by the Gulf on the north, and separated by Northumberland Strait from New Brunswick on the east and Nova Scotia on the south; greatest length, from east to west, about 130 miles; breadth, varying from 4 to 34 miles; area, about 2134 square miles, or 1,365,760 acres, of which over 1,000,000 are under cultivation. The coast-line presents a remarkable succession of large bays and projecting headlands. Of the latter the most prominent are North Cape on the north-west, West Cape on the south-west, and East Cape on the north-east; the largest bays are those of Richmond on the north-west, Egmont on the south-west, Hillsborough on the south, and Cardigan on the east. The surface undulates gently, nowhere rising so high as to become mountainous, or sinking so low as to form a monotonous flat. At one time the whole island was covered with a dense forest of beech, maple, fir, and other trees, a great part of which still remains. The whole island is eminently agricultural and pastoral. The soil consists generally of a light reddish loam, sometimes approaching to a strong clay, but more frequently of a light and sandy texture. The prevailing rock is a reddish sandstone, but a large part of the surface is evidently alluvial. No minerals of the least consequence have yet been discovered, and even limestone and gypsum appear to be wanting. The climate is much milder than that of the adjoining continent, and the air, generally free from the fogs which spread along the shores of Cape Breton and Nova Scotia, is remarkably salubrious. Winter, though longer and colder than that of England, is free from its damp unwholesome chills; and summer, without being oppressively hot, is eminently fitted to promote the growth and maturity of all the ordinary cereals. During the greater part of July, August, and September the thermometer during the hotter hours of the day seldom varies more than from 75° to 80° Fahr., while the night air is soft, wholesome, and agreeable. The favourite live-stock is sheep, which are not subject to rot, and though small in size, give mutton of rich flavour. The fisheries along the coast are very productive, the value of the fish caught in 1882 being over £370,000. The most valuable item in the catch is the lobster, followed by the mackerel, cod, herring, and hake. The manufactures are chiefly confined to linen and flannels for domestic use; there are also several tanneries, and ship-building is carried on to a considerable extent. The exports consist of timber, agricultural produce, and live-stock; the imports of dry goods, hardware, cordage, iron, &c. The capital is Charlottetown, which has a population of 10,000, and is being connected with all the principal towns in the island by railway. The public affairs of the island are administered by a lieutenant-

governor nominated by the crown, who appoints an executive council of nine members. There is also a legislative council of thirteen and a house of assembly of thirty members, both chosen by the people. Who discovered Prince Edward Island is not accurately known, but Cabot is supposed to have seen it immediately after he had discovered Newfoundland. Champlain gives it the name of St. John, by which it continued long to be designated, and accurately describes both its situation and extent. It was afterwards included by the French in their vast and undefined territory of New France, and in 1663 was granted as a feudal tenure to a Sieur Doublet, a French naval officer. Little progress was made in settling the island till after the Peace of Utrecht in 1715, when its fertility allured great numbers of Acadians from Cape Breton. It was taken by the British in 1745, restored by the Peace of Aix-la-Chapelle, retaken, and finally annexed to Britain in 1758. In 1873 it was admitted into the Dominion of Canada. Pop. (1881), 108,891.

PRINCE OF WALES, the title of the heir-apparent of the British throne, first conferred by Edward I. on his son (afterwards Edward II.), at the time of his conquest of the Principality of Wales. According to the well-known tradition Edward I. promised to give the Welsh a prince born in their own land, and unable to speak a word of English. This promise was very satisfactory to those to whom it was made, but was one of those kept to the ear but broken to the sense, for Edward fulfilled it by appointing his infant son Edward, who was born in Wales, and could not speak a word of any language. But the truth appears to be that the title was not bestowed upon Edward of Caernarvon till 1300 or 1301, seventeen years after the conquest of Wales, and sixteen after the birth of Prince Edward. Edward III. was never Prince of Wales, but the title has been conferred on all the male heirs-apparent to the English (and afterwards the British) throne from Edward the Black Prince, son of Edward III. The heir-apparent is made Prince of Wales and Earl of Chester by special creation and investiture, or by proclamation, but as the king's eldest son is by inheritance Duke of Cornwall, without any new creation. The title of Duke of Cornwall was first conferred on Edward the Black Prince, as eldest son of the king, in 1337. As heir to the crown of Scotland the Prince of Wales bears the titles of Prince and High-steward of Scotland, Duke of Rothesay, Earl of Carrick, Baron of Renfrew, and Lord of the Isles, in virtue of an act of the Scottish Parliament of 1469. The title of Earl of Dublin was bestowed upon the present Prince of Wales on September 10, 1849, when it was also ordained that that dignity should belong to him and his heirs, kings of the United Kingdom of Great Britain and Ireland, for ever. A statute of the order of the Garter, dated 1805, declares that the Prince of Wales shall, as soon as he receives this title, become a knight of the Garter. The arms of the Prince of Wales are the royal arms, with the addition of a label of three points argent, and any other addition that may be adopted by the different holders of the title. Thus the present Prince of Wales bears *en surtout*, the escutcheon of the house of Saxony. The Prince of Wales has also a badge, consisting of a plume of three white ostrich feathers, with the motto *Ich dien* (I serve), said, but on questionable authority, to have been adopted by the Black Prince from a prince of Bohemia whom he slew at Crécy. Another account says that when Edward I., according to the tradition already mentioned, presented his infant son to the Welsh as their native prince, he used the words *Eich dyn* (This is your man), from which the present motto is corrupted. The consort of the Prince of Wales is called Princess of Wales, but when the sovereign has no son this title is bestowed upon the eldest daughter. To compass or conspire the death of the Prince of Wales is as much high treason as to conspire the death of the king, as is also the violation of the chastity of his consort.

PRINCE OF WALES ISLAND. See PENANG.

PRINCE RUPERT'S DROPS, pieces of glass which have been cooled very suddenly from the melted state by having been dropped into water. If we imagine an egg lengthened in the direction of its axis so that it has no small rounded end, but a lengthy tail tapering gradually to a point, we shall have a magnified image of one of these drops. They are called *larmes bataviques* (Dutch tears) by the French; we also call them Dutch tears sometimes. The outside of the drop of melted glass is instantaneously solidified by the water, while the inside cools gradually, so that the outside shell is acted upon by very great stresses due to contraction of the internal portions when cooling. In fact the drop is kept in a state of excessive strain by stresses in unstable equilibrium; and if this equilibrium is destroyed by scratching the surface with a diamond, or breaking off the tip of the tail, the strained particles are violently released, and the mass is instantly pulverized. Heat is produced during the pulverization of the drop. This explanation applies to the falling out of the bottom of the very thick flask of unannealed blown glass called the 'Bologna flask,' when its surface is scratched. We see, then, that glass articles —articles of any brittle material—ought to be cooled very slowly from the melted state. The process of slow cooling to which such articles are subjected is called annealing. To anneal glass it is placed in a large furnace which has nearly a red-heat at one end and a lower temperature than 100° C. at the other; after the glass has been passed very slowly from the heated to the cool end it is able to withstand sudden changes of temperature, &c., without fracture.

PRINCE'S METAL, or PRINCE RUPERT'S METAL, a mixture of copper and zinc in imitation of gold.

PRINCETON, a small town of the United States, in Mercer county, New Jersey, 40 miles north-east of Philadelphia, and near the New Jersey Railway and the Delaware and Raritan Canal. It is the seat of the Princeton College, one of the first literary institutions in the country, founded by the Presbyterians at Elizabethtown in 1746, and removed hither in 1757. The town contains several churches, a bank, and a celebrated theological seminary of the Presbyterian Church. A battle was fought here in 1777 between the Americans under Washington and the British under Colonel Mawhood, in which the latter were defeated. Pop. (1880), 3209.

PRINCIPAL, in criminal law, either the actual perpetrator of the crime, or one who is present, or in the immediate vicinity, aiding and abetting the perpetrators. See ACCESSARY.

PRINCIPAL, the name given to the heads of the Scottish universities, and of several colleges in the English universities. By the Act of Union in 1707 principals, as well as others bearing office in any of the four universities of Scotland, were required to subscribe to the Westminster Confession of Faith; but this enactment has since been repealed.

PRINCIPAL AND AGENT, a designation in law, under which are classed the various questions which occur between mercantile agents and their employers, as to the extent of their duties and responsibilities. See AGENT, BROKER, FACTOR.

PRINCIPATO-CITRA AND PRINCIPATO-ULTRA, called also by the new designations of *Salerno* and *Avellino* respectively, two provinces in the Kingdom of Italy. The former, immediately

south of the other, and bounded west and south by the Mediterranean, and east by Potenza, has an area of 2117 square miles, an irregular coast-line jutting out into several bold promontories, and inclosing the Bay of Salerno; an interior much broken by ramifications of the Apennines; a fine climate, a very fertile soil, magnificent forests, and valuable tunny and anchovy fisheries. Pop. in 1881, 544,621.—The latter, with an area of 1402 square miles, is mountainous, but has deep, fertile, and well-cultivated valleys, in which maize, olives, and wine are the chief crops. Pop. (1881), 393,228. The chief towns of Principato-Citra are Salerno, the capital (from which it has been re-named), Sarno, and Pagani; of Principato-Ultra, Avellino, the capital (from which it has been re-named), and Ariano.

PRINCIPLE OF THE CONSERVATION OF ENERGY, a general denial of the possible existence of a perpetual motion. When a body is in motion it has power to do work when being brought to rest; its energy is said to be 'kinetic.' The kinetic energy of a body, (1) due to its motion as represented by the motion of its centre of gravity, and (2) due to its motion of rotation about any axis, may be calculated—that is, we can calculate the amount of mechanical work which it has power to do, if we know the form and density of the body and its motions. But in determining its kinetic energy due to the molecular invisible motions which we know to exist, but which we are unable to measure as motions, we are forced to depend upon the determinations of experimental physicists. Thus heat is known to be a molecular kinetic energy, and Joule has determined how much mechanical work is equivalent to a certain quantity of heat; so that heat may be measured, just as if it were a visible kinetic energy, in units of work. The energy which a system of bodies possesses in virtue of its configuration is called its 'potential energy;' it is the amount of work which the system is capable of doing by changing its configuration. Thus when a stone is 6 feet above the surface of the earth it can do a certain measurable amount of work in falling, in virtue of the force of gravity; and this power to do work is less if the stone is at a less height. Gunpowder contains, in a dominant form, an immense store of energy—that is, it has power to do an immense amount of work. This energy is possessed by it in a small compass, in virtue of its chemical constitution. The driving-weight of a clock, when wound up, has potential energy in virtue of its position; when it has run down it can no longer drive the clock. If water has power to fall it has potential energy, and may, in falling to a lower level, drive mills or other machinery; the height through which it may fall is technically called its 'head.' In an air-gun there is a store of potential energy in the form of compressed air; in a wound-up watch, in the form of a bent spring; in a charged Leyden-jar, in the form of a distribution of electricity; in a voltaic battery, in a chemical arrangement; in a labourer ready for work, in the form of a proper supply of food. To all these dormant energies the name potential energy is given. When the forces acting in a system of bodies are all known the potential energy of the system may be measured. But in determining the molecular potential energy of a body, whether existing in the forms of strain, magnetism, latent heat, or electricity, &c., we must depend upon the experimental determinations of equivalents given by physicists. If the stone referred to above were to fall freely towards the earth potential energy would be lost by it, but an equivalent amount of kinetic energy would be gained, and at every instant the sum of its kinetic and potential energies is the same. Thus when a projectile is discharged vertically upwards it possesses no potential energy at the beginning, its energy is all kinetic—that is, due to its motion. But as it rises it loses kinetic and gains an equivalent amount of potential energy, and as it falls again it loses potential and gains an equivalent amount of kinetic energy, and the sum of the kinetic and potential energies is always the same so long as there is no friction. When a pendulum oscillates, the energy originally given to the bob, whether in the kinetic form by projecting it from its lowest position, or in the potential form by drawing it aside from the vertical and then letting it fall, is continually transformed and retransformed every quarter oscillation. We might repeat these observations for the oscillations of any elastic body, the balance-spring of a watch, a tuning-fork, &c., assuming that there is perfect elasticity, else we should have to take into account the heat due to molecular friction. So long as there is no friction or viscosity, so long as heat or electricity or some form of molecular energy is not supposed to be created, the fact just stated may be easily proved by dynamical principles, and indeed if we assume that in any material system not acted upon by external forces the force acting between any two points is in the line joining them, and depends only on their distance asunder, and not on their motions at the time, we have dynamical proof that the sum of the potential and kinetic energies of the system will always remain the same. This is the principle of conservation of energy, the most important principle of modern philosophy. Thomson and Tait state it as follows:—'If a system of bodies, given either at rest or in motion, be influenced by no forces from without, the sum of the kinetic energies of all its parts is augmented in any time by an amount equal to the whole work done in that time by the mutual forces, which we may imagine as acting between its points. When the lines in which these forces act remain all unchanged in length the forces do no work, and the sum of the kinetic energies remains constant. If, on the other hand, one of these lines varies in length during the motion, the mutual forces in it will do work, or will consume work, according as the distance varies with or against them.' We have very strong reasons for believing that energy must be either potential or kinetic, and that the above assumptions as to forces which are known to be true in the case of attraction of bodies at a distance are true generally; yet we can only say with regard to the following general statement of our principle that it has been proved by experiment to be true within the limits of observational errors in cases where energy takes the forms of heat, magnetism, electricity, &c., and that no known fact disagrees with it. 'The total energy of any body or system of bodies is a quantity which can neither be increased nor diminished by any mutual action of these bodies, though it may be transformed into any of the forms of which energy is susceptible.' Newton was not aware of heat being a form of energy, but on the supposition of no loss of mechanical energy by friction he, in a scholium to his third law of motion, enunciated our principle with great clearness. The leading dates in the history of the subject are given in the article JOULE'S MECHANICAL EQUIVALENT OF HEAT. In January, 1843, Joule showed that mechanical work can be converted into an equivalent of heat by first converting it into induction currents of electricity; so that current electricity is a form of energy subject to the principle of conservation. He was thus led to the establishment of the principle in chemical action. The experimental verification of the principle in its generality, and the earliest suggestions of many of its applications, belong to Joule. Joule's

work has been extended by Helmholtz, Mayer, Rankine, and Thomson. Helmholtz (1847) founds the science of thermodynamics on Newton's principle, and on what he assumes as axioms—(1) the perpetual motion is impossible, and (2) the assumptions regarding forces given above. One of these assumptions is enough, for the one follows from the other. But many logical objections might be made to either of these assumptions, and they only give way when opposed by the facts discovered by Joule. For instance, Weber's hypothesis of the mutual action of currents, which receives a great amount of authority from experiment, requires the admission of mutual forces between moving quantities of electricity which are not consistent with the second axiom, and from which, therefore, a perpetual motion might be obtained; but here Joule's facts determine the truth of the axiom, and hence Weber's results merely show that electricity does not consist of two sets of particles, vitreous and resinous, as he had assumed. The theory of energy contemplates its conservation, transformation, and dissipation. In the article PERPETUAL MOTION these principles have been enunciated. It follows from them that as energy is constantly in a state of transformation there is a constant degradation of energy to the final unavailable form of uniformly diffused heat; and that this will go on as long as the transformations occur, until the whole energy of the universe has taken this final form. The law of dissipation of energy, discovered by Thomson, seems to be the most complete and most general statement of the whole theory of energy. We conclude with some further illustrations of the principle of conservation. When in perihelion a planet's potential energy is least and its kinetic energy is greatest, but at every part of the orbit the sum of these energies is the same. In the case of a comet moving in a parabolic orbit the sum of the kinetic and potential energies at any time is equal to the potential energy at an infinite distance from the sun. As the comet recedes from the sun its velocity and kinetic energy get less and less. In these cases we are merely concerned with Newton's law; we assume that there is no conversion of kinetic energy into heat by friction. When elastic bodies collide there is a loss of visible kinetic energy in the system; this loss is merely a transformation into energy of vibration of the body and into heat. Some of the loss is due to the vibrations given up to the air, and communicated as sound; the energy of all these vibrations is eventually converted into heat, through imperfect elasticity and viscosity of the vibrating bodies. We may mention the conversion of mechanical work into heat by friction in the experiments of Rumford and Joule. Kinetic energy is converted into heat by friction between ordinary matter and the interstellar ether; Professors Stewart and Tait heated a disc by rotating it rapidly in a vacuum. Fresnel, in his hypothetical deductions by dynamical principles of the polarization of light by reflection and refraction, assumed the law of conservation of kinetic energy, and arrived at laws which are justified by experiment. The direct relations between mechanical work and heat are further referred to in the article THERMODYNAMICS. When any two bodies are in contact a certain definite difference of electric potential is established between them; this difference depends simply on the nature of the bodies. The bodies attract each other more than they did before, and this in virtue of their charges of electricity. More work has to be done in taking them asunder than was gained in letting them come together, and this work appears in the potential form of separate charges of electricity. In the electric machine, contact between a rubber and a portion of a plate of glass creates a separation of electricities, and when the rubber and plate are removed from one another the separate charges may be collected. The electrophorus gives us another good instance of the conversion of mechanical work into potential energy of separated electricities. (See also POTENTIAL.) Thomson, in the Bakerian Lecture (1856), states that the primary cause of all friction is a separation of electricities. A mathematical investigation shows us that the potential energy of a charge of electricity is proportional to the square of the quantity of electricity in the charge, and thus the experimental law—the heat evolved by an electric discharge depends on the square of the charge—accords with the principle of conservation of energy. Readers who care to see how the great experimental laws of physics accord with the theory of energy ought to read carefully the first two chapters of Tait's Thermodynamics. We give a short list of the most interesting examples. Green's law for the capacity of a Leyden-jar; Thomson's no-liquid mechanical galvanic cell; Faraday's and Thomson's laws of electrolytic action; the actions of magnets on one another; Arago's rotating copper disc; the mutual action of magnets and currents of electricity; magnetization by currents; Seebeck's discovery and Thomson's development by the laws of energy, as experimentally verified by Le Roux. Thomson and Helmholtz showed independently that Faraday's laws of induction may be immediately deduced from Oersted's results by means of the laws of energy. Applications of this kind are every day indicating how to co-ordinate some newly discovered fact, and even occasionally to predict the result of a perfectly novel experimental arrangement.

PRINTERS, LAW RELATING TO. Various restrictive measures having reference to the rights of printers are at present in force. A printer has no right to publish any work he has in his hands; but he has the power of retaining the printed sheets until the price of his labour be forthcoming. The statute 39 Geo. III. cap. lxxix. (amended by 51 Geo. III. cap. lxv., and 2 and 3 Vict. cap. xii.), entitled An Act for Suppressing Seditious and Treasonable Practices, provides, in order to suppress seditious publications, that every type-founder and printing-press maker must, before commencing business, give notice to the clerk of the peace for the district in which the same is to be carried on, and obtain from him a certificate of registration, failing which he is liable in a penalty of £20. Such persons must also under the same penalty keep, and produce to any justice on his written demand, a statement in writing of the purchasers of their types or presses. The same penalty is also incurred by any person (except the queen's printers and the printers at the university presses of Oxford and Cambridge) who uses a printing-press or types without having the fact duly registered by the clerk of the peace. The printer must also write the name and residence of his employer on one copy of any book or paper he prints, retaining this copy for six months after it has been printed, and producing it when required to do so by any justice of the peace; otherwise he is liable in a penalty of £20. Every printer who shall print a book or paper without having his name or residence on the first or last leaf thereof shall, by act 2 and 3 Vict. cap. xii. s. 2, forfeit £5 for every copy printed. Certain papers are exempted from the operation of these acts, such as papers printed for the use of Parliament by its authority, or by authority of any public board or officer, or law proceedings, bankrupts' bills, receipts, securities for money, policies of insurance, letters of attorney, deeds of agreement, bills of lading, impressions of engravings, advertisements of tradesmen or of sales, &c.

PRINTERS' INK. See INK.

PRINTING, in a general sense, is the art of stamping impressions of figures, characters, or letters, with ink, upon paper, vellum, silk, or any similar substance; in a more particular sense it is the term applied to that art by which, with single movable letters or types, any piece of literary composition is transferred to paper. Printing, in its extended sense, thus embraces the taking of impressions of wood and copper-plate engravings, lithographs, and even the decoration of calicoes; but the last two subjects are treated under CALICO-PRINTING and LITHOGRAPHY, and we shall here consider mainly printing in its most common meaning, that is, *typography*, or the art of printing paper with movable metal types, together with printing from wood blocks and engraved plates.

The rudiments of this art were undoubtedly known to the ancients. It was practised in the East from a very early period. It is evident from undecayed bricks which have been found, having various symbolical and hieroglyphic characters impressed upon them, that a rude kind of printing was known to the Assyrians. Its application, however, could only be extremely limited, the impression being taken from the block. Still this style of printing is that used by the Chinese up to the present day. At what time it was introduced it is impossible to determine; the Chinese themselves claim an antiquity for it long before the commencement of the Christian era, and it is denied by none, even of the Christian writers, that it was fully established in China early in the tenth century, nearly 500 years before printing was contemplated in Europe. The Chinese method of printing, which has remained unaltered for ages, is as follows: The work intended to be printed is transcribed upon thin, transparent paper; each written sheet is glued, with its face downward, upon a smooth block of wood; the engraver cuts the wood away in all those parts upon which he finds nothing traced, and thus leaves the transcribed parts ready for printing. Thus there must be as many blocks as there are pages in a book, and these blocks are not of the least use in printing any other work. The system, however, has one advantage, but no other, in common with stereotype, that by it impressions of a work may be thrown off just as required. Various attempts have been made to introduce printing from movable types into China, but without being attended by any ultimate success. The ancient Romans made use of metal stamps, with characters engraved in relief, to mark their articles of trade and commerce; and Cicero, in his work De Natura Deorum, has a passage from which Toland imagines the moderns have taken the hint of printing. Cicero orders the types to be made of metal, and calls them *formæ literarum*, the very words used by the first printers. In Virgil's time, too, brands with letters were used for marking cattle, &c., with the owner's name.

Block-printing in Europe, with single pieces of wood, can be traced back as far as the thirteenth century. The introduction of playing-cards early in the fourteenth century is supposed to have given an impetus to the art of wood-engraving. From single figures the professors of the art came to engrave historical or biblical subjects, some with a text or explanation subjoined, others without a text. Of the former of these the oldest and most celebrated extant is the Speculum Humanæ Salvationis; of the latter, the Biblia Pauperum. (See a description and fac-similes of both in Horne's Bibliography.) These books of Images, as they were called, may be considered as the earliest attempts at book-printing in Europe; and although there is little likelihood that the practice of the art was derived from China, they resembled Chinese books in one essential point, each leaf being printed from single blocks of wood. The great discovery was yet to be made, which was to emancipate the art from its fixed thraldom, and give it a pliability and power beyond all previous conception—the discovery, namely, of the practicability and utility of adopting *movable* types.

It is a matter of much dispute to whom is due the merit of making this, in its results, unparalleled discovery. Nor, after all that has been written on the subject, can a very distinct or satisfactory conclusion be attained. Many claims have been adduced, but the real question seems to lie between those of Laurence Coster of Haarlem and John Gutenberg or Gensfleisch of Mainz, all others being groundless or puerile. The advocates for Haarlem maintain, chiefly on the authority of Hadrian Junius, who flourished about 100 years after the introduction of the art, that Coster as early as 1430 not only practised the art of cutting on wooden tables, but made impressions with movable types of wood, and afterwards of lead and tin. But no undoubted specimen of his work has come down to us, and his claims have been pretty satisfactorily refuted (see COSTER). The best that can be said of him is that he was in all probability an ingenious wood-engraver, who carried the practice of his art to a higher state of perfection than those of his contemporaries, and who even went so far as to employ separate wooden types in the construction of broadsides for alphabets, breviaries, &c. To Gutenberg, according to the opinion of the most numerous and competent judges, belongs the credit of having first employed movable metal types in the production of books—of having, in short, been the first to supplant the ancient, tedious, and expensive method of manual transcription by letter-press printing. Gutenberg was a native of Mainz, but his early life was spent at Strasburg, and it is doubtful whether it was in the former or latter city that he first prosecuted his art. (See GUTENBERG.) The probability is that he first conceived the idea of his invention, and made a few experiments of it at Strasburg, but it was at Mainz where he first brought the art into practical use. Gutenberg left Strasburg for Mainz in 1448, and from that period may be dated the commencement of the art of printing, although it has been proved that movable letters in wooden blocks must have been used earlier than 1442. In 1449 Gutenberg connected himself with a rich citizen in Mainz, named Johann Fust or Faust, who advanced the capital necessary to prosecute the business of printing. Soon after (probably in 1453) Peter Schöffer, who afterwards became Fust's son-in-law, was taken into copartnership, and to him belongs the merit of inventing matrices for casting types, each individual type having hitherto been cut in wood or metal. This discovery is one of the most invaluable in the history of printing, and so much did it facilitate the art that Schöffer, before his death, which is supposed to have taken place about 1492, printed upwards of fifty works. The oldest work of any considerable size printed in Mainz with cast letters, by Gutenberg, Fust, and Schöffer, finished about 1455, is Gutenberg's Latin Bible, which is called the Forty-two lined Bible, because in every full column it has forty-two lines, or the Mazarine Bible, from a copy having been discovered in the library of Cardinal Mazarin in Paris. Fust having separated from Gutenberg in 1456, and obtained the printing-press for his own use, undertook, in connection with Peter Schöffer, greater typographical works, in which the art was carried to higher perfection. Fust was particularly engaged in the printing of the Latin and German Bible, the first copies of which, bearing date, were printed in 1462. Fust is said to have died of the plague in 1466 at Paris (see FAUST), upon which

Peter Schöffer continued the printing business alone at Mainz. After the separation of Gutenberg and Fust the former had found means to procure a new printing-press, and had struck off many works, of which the most remarkable is the Astrological and Medical Calendar (in folio, 1457), considered the first known work printed with the date annexed.

In 1462 the city of Mainz was taken and sacked by Adolphus, count of Nassau, and this circumstance is said to have so deranged the establishment of Fust and Schöffer that many of their workmen were obliged to seek employment elsewhere. They accordingly were dispersed into different countries, and carried with them the knowledge they had acquired under their former employers. From this period printing made rapid progress throughout Europe. In 1465 we find works printed at Naples; and in 1467 Sweynheim and Pannartz, two of the most celebrated and extensive old printers, established themselves at Rome. In 1469 we find printing at Venice and Milan; in 1470 at Paris, Nuremberg, and Verona; and by 1472 the art had become known in all the important cities of the Continent. In 1490 it had reached Constantinople, and by the middle of next. century had extended to Russia and America. Of its rise and progress in England and Scotland we shall come to speak immediately.

At the invention of printing the character of type employed was the old Gothic or German. The *Roman* type was first introduced by Sweynheim and Pannartz at Rome in 1467, and the *Italic* by Aldus Manutius about 1500. Schöffer, in his edition of Cicero's De Officiis, produces for the first time some Greek character, rudely executed; but the earliest complete Greek work was a grammar of that language printed at Milan in 1476. The Pentateuch, which appeared in 1482, was the first work printed in the Hebrew character, and the earliest known Polyglot Bible—Hebrew, Arabic, Chaldaic, Greek, Latin—issued from the press of Genoa in 1516. In the early history of the art of printing the most learned men were proud to act as correctors of the press, and not unfrequently their name was attached to the title-page along with that of the printer.

The reader who has not studied Bibliography may here not be unwilling to learn a few of the marks which distinguished our earliest printed books. With regard to their forms they were generally either large or small folios, or at least quartos—the lesser sizes were not in use. The leaves were without running title, direction-word, number of pages, or divisions into paragraphs. The character itself was a rude old Gothic mixed with Secretary, designed on purpose to imitate the handwriting of those times; the words were printed so close to one another that they were difficult and tedious to be read even by those who were used to manuscripts and to this method, and often led the inattentive reader into mistakes. The orthography was various and often arbitrary, disregarding method. Words were subjected to frequent abbreviations, which in time grew so numerous and difficult to be understood that there was a necessity of writing a book to teach the manner of reading them. Periods were distinguished by no other points than the double or single one, that is, the colon and full-point; but a little after there was an oblique stroke introduced, thus /, which answered the purpose of our comma. No capital letters were used to begin a sentence or for proper names of men or places. Blanks were left for the places of titles, initial letters, and other ornaments in order to have them supplied by the illuminators, whose ingenious art, though in vogue before, and at that time, did not long survive the masterly improvements made by the printers in this branch of their art. These ornaments were exquisitely fine, and curiously variegated with the most beautiful colours, and even with gold and silver; the margins, likewise, were frequently charged with a variety of figures of saints, birds, beasts, monsters, flowers, &c., which had sometimes relation to the contents of the page, though often none at all: such embellishments were very costly; but for those who could not afford a great price there were inferior ornaments, which could be done at a much easier rate. The name of the printer, place of his residence, &c., were either wholly neglected or put at the end of the book, not without some pious ejaculation or doxology. The date was likewise omitted or involved in some cramped, circumstantial period, or else printed either at full length or by numeral letters, and sometimes partly one and partly the other; thus, *one thousand* CCCC *and* lxxiiii., &c., but all of them at the end of the book. There was no variety of characters, no intermixture of Roman and Italic—these are of later invention; pages were continued in a Gothic letter of the same size throughout. Two or three hundred copies were at first esteemed a large impression, though, upon the encouragements received from the learned, the numbers increased in proportion. About 1470 alphabetical tables of the first words of each chapter were introduced as a guide to the binder. Catch-words (now generally abolished) were first used at Venice by Vindeline de Spira. The name and place of the inventor of signatures is doubtful; it appears they were inserted into an edition of Terence printed at Milan in 1470 by Anthony Zorat. In an edition of Baldi Lectura super Codic., &c., printed at Venice by John de Colonia and Jo. de Manthen de Gherretzem, anno 1474, in folio, the signatures are not introduced till the middle of the book, and then continued throughout. Abbé Reve ascribes the first use of signatures to John Koelhof at Cologne in 1472. They were used at Paris in 1476, and by Caxton in 1480.

The art of printing was first introduced into England by William Caxton, who established a press in Westminster Abbey some time between 1471 and 1474. Caxton's claim to be considered the earliest printer in England has been satisfactorily proved notwithstanding the discovery about 1660 of a book purporting to have been printed at Oxford in the year 1468. This book is a small thin quarto, a copy of which is in the public library at Cambridge, bearing the following title: 'Exposicio Sancti Jeronimi in Simbolum Apostolorum ad Papam Laurentium. Impressa Oxonii, et finita Anno Domini M.CCCC.LXVIII.—XVII. die Decembris.' The printer of this book is said to have been Frederick Corsellis, a foreigner, who brought his types from Haarlem; and those writers who have advocated the cause of Laurence Coster as the inventor of printing have generally pronounced Corsellis to be the introducer of the art into England. But Dr. Conyers Middleton in his treatise on the origin of English printing has clearly demonstrated that the date affixed to the 'Exposicio' must be a mistake, for the book itself bears unequivocal marks of belonging to a somewhat later period. Not to mention other matters of a technical nature which go to prove this it may be enough to say that *signatures* are used in distinguishing the sheets of the work—a circumstance which does not characterize any other book with so early a date as 1468, signatures not having been adopted for several years later. From that date also till eleven years after we have no production from any Oxford press, and it is difficult to imagine how so long a cessation of the Oxford press should have taken place supposing the above date to have been correct. The only satisfactory way of accounting for the matter is by assuming an X to have been omitted through mistake in the imprint of the Exposicio, and that its true date was M.CCCC.LXXVIII. (1478). Similar inaccura-

cies were by no means rare in the early history of the art. There is a Bible at Augsburg of the date 1449 instead of 1494, the two last figures being transposed. There is a Bible dated Paris, 1443, another Lyons, 1446, and a third Basel, 1450, although it is well known that printing was not practised at any of these places till considerably later. Koelhoff, who printed at Cologne about the beginning of the sixteenth century, might be placed before even Gutenberg, for one of his books is dated 'anno M.CCCC.' (1400 instead of 1500), a C being omitted; and the celebrated Nicholas Janson, who printed at Venice between the years 1470 and 1480, has a work (the Decor Puellarum) dated M.CCCC.LXI. instead of M.CCCC.LXXI., an X being omitted.

But even though the date of the Exposicio were correct (of which there is little likelihood), and though, by some singular incident, one little book were printed in Oxford several years earlier than any in Westminster Abbey, still William Caxton must ever be considered as the father of English typography, not only as having been the first who successfully established the art in this country, but as having, by his learning, application, and ingenuity, done much towards its improvement and extension. He was born in the weald of Kent about the year 1412, and would appear to have received a good education—a circumstance of unusual occurrence in these days, except among the titled and wealthy. 'I am bounden,' he says, 'to pray for my father and mother, that in my youth sent me to school, by which, by the sufferance of God, I got my living, I hope truly.' When about fifteen he was put apprentice to William Large, a mercer of London, and afterwards mayor. The term *mercer* was given at this time to general merchants, trading in all kinds of rich goods, books included. After he had served his apprenticeship Caxton became a freeman of the company of mercers and a citizen of London. Some subsequent years he spent in travelling in various countries on the continent of Europe. In 1464 he was appointed ambassador to the court of the Duke of Burgundy. It was at the request of the Duchess of Burgundy that he finished his translation of the History of Troy. During his residence in the Low Countries he acquired or perfected his knowledge of the French language, gained some knowledge of the Flemish, imbibed a taste for literature, and at great trouble and expense made himself master of the art of printing. It is conjectured that he consulted Zell and Olpe of the Cologne press (who had learned the art at Mainz) and Colard Mansion of Bruges as to the materials necessary for his office. He is supposed to have returned to his native country about 1471, but we have no account of his typographical labours till 1474, the date affixed to the Game of Chess, which is generally considered the first book printed by Caxton, though Mr. Dibdin thinks that the Romance of Jason was printed before it. Caxton was indefatigable in cultivating his art. The productions of his press amount to sixty-four. For a catalogue of them, and of the productions of other early printers, we refer to the Rev. Dr. Dibdin's Typographical Antiquities, or to Dr. Watt's Bibliotheca Britannica. Besides the labour necessarily attached to his press, he translated various works; among others, Virgil's Æneid from the French, published with the title The Recuyel of the Historyes of Troye, and Æsop's Fables, a copy of which is in the Bodleian Library. He seems to have been perplexed about the language he should use in his translations; for while some advised him to use old and homely terms, others, 'honest and great clerks,' he adds, 'have been with me, and desired me to write the most curious terms I could find—and thus, betwixt plain, rude, and curious, I stand abashed.' In 1480 he published his Chronicle and his Description of Britain, which were both very popular, having been reprinted four times in the fifteenth, and seven times in the sixteenth century. Among other books which he published were two editions of Chaucer's Tales, and it speaks well for the discrimination of the father of English printing, that he seems highly to have admired and appreciated the father of English poetry. Caxton died in 1490–91, and was buried in the parish church of St. Margaret, Westminster. Caxton distinguished the books of his printing by a particular device, consisting of the initial letters of his name, with a cipher between, which some imagine to stand for seventy-four, and to refer to the first year of his printing in England. His first performances were very rude, the characters resembling those of English manuscripts before the Conquest. Most of his letters were joined together; the leaves were rarely numbered, the pages never. At the beginning of the chapters he only printed, as the custom then was, a small letter, to intimate what the initial or capital letter should be, leaving that to be made by the illuminator, who wrote it with a pen, with red, blue, or green ink.

Caxton's two most distinguished successors were Wynkin de Worde and Richard Pynson. The former, a native of the Dukedom of Lorraine, served under Caxton, and after the death of his master successfully practised the art of printing on his own account. The books which he printed are very numerous, and display a rapid improvement in the typographic art. He died in 1534. Pynson was a native of Normandy, and it is supposed that he also served under Caxton. The first book of his which is known with a date, states that it was printed 'the V day Juyl. the yere of oure lord god. m.cccc.lxxxxiii. by me Richarde Pynson at the Temple-barre of london.' How long he exercised the art, or when he died, is not exactly known. The works which he printed are neither so numerous nor so beautiful as those of Wynkin de Worde. He was the first printer, however, who introduced the Roman letter into England. To Wynkin de Worde and Pynson succeed a long list of ancient typographers, into which we cannot enter here. Their various works and characteristics will be found duly recorded and honoured in Dr. Dibdin's splendid edition of Ames and Herbert's Typographical Antiquities. Before the middle of the sixteenth century printing had reached a flourishing condition in England. In the reign of Henry VII. and his successor, English printers, we are told, had become 'so skilful, as to print books as well as any beyond the seas.'

The art of printing is said to have been introduced into Scotland shortly after Caxton's day by Flemish priests, who fled thither to avoid the persecutions at home. No book, however, is known to exist as having been printed in Scotland before the year 1500. The first Scottish printers of whom we have any authentic account were Walter Chapman, a merchant in Edinburgh, and Andrew Millar, a workman, who, in consequence of a patent from James IV., established a press at Edinburgh in 1507, that is, fully thirty years after Caxton had settled in London. 'In 1508,' says Dr. Irving, 'they are known to have printed various pamphlets, a collection of which may be found in the Advocates' Library.' The first volume of the Breviarium Aberdonense issued from their press in 1509; the second in 1510. Of this very rare book a complete and well-preserved copy belongs to the library of the University of Edinburgh. The establishment of printing-presses in the other principal towns of Scotland cannot be so easily

traced. Knox's Faithful Admonition unto the Professours of God's Treuthe in England was, if we may credit the title-page, printed at *Kalykow* or Kelso. This work appeared in 1544. Aberdeen, the seat of a university, could not boast of a printing-press till a much later period. In the colophon of a poem (1635) on the death of Bishop Forbes, Edward Raban styles himself '*Master printer, the first in Aberdene.*' About the same year (1635) we find books printed in Glasgow. In 1536 Thomas Davidson printed, 'in the Fryere's Winde,' Edinburgh, the Chronicles of Scotland, by Boethius, and in 1540 the works of Sir David Lindsay. Robert Leprevig printed extensively both at Edinburgh and St. Andrews. Thomas Vautrollier was another old Scottish printer, who brought out, in 1585, Calvin's Institutes; in 1589, Tusser's Points of Good Husbandry; and in 1597 the Demonologie of King James VI.

In later days Scotland has distinguished itself by the extent and beauty of its typographical productions. Ruddiman, who flourished at Edinburgh during the first half of the last century, was one of the most learned printers which any country has produced. The works which he edited and printed are numerous, and they are all remarkable for their accuracy. Edinburgh can boast of many other typographers who have exerted themselves successfully in ennobling the art; nor has Glasgow been behind in this labour of love. In Urie, in Robert and Andrew Foulis, in the Duncans, and others, the latter city has produced printers whose works are alike celebrated for their elegance and accuracy.

It was long after the invention that printing was introduced into Ireland. In 1551 the Common Prayer was printed in Dublin, by Humphrey Powel, 4to, black letter, and this is the earliest recorded production of the Irish press. The college library catalogue affords but one piece printed there so early as even 1633. Indeed, until as far down as 1700 very few books were printed in Ireland. Alderman George Faulkner, who lived in the last century, may be considered as the father of Irish typography. At the present day the presses of Dublin and some of the provinces produce very neat work.

Process of Letter-press Printing.—In order to give a full account of letter-press printing it would be necessary to begin with a description of the operation of type-founding; but to avoid extending the present article to undue limits, we refer the reader for information on that subject to our special article TYPE-FOUNDING. It is sufficient for the reader at present to know that every letter, point, and mark used in printing is cast (with one or two exceptions) on a distinct body or stalk, and that for the use of the printer numbers of these types are placed in cells or boxes, in order, in a case, in such a way that any letter or point may be found with the greatest convenience.

These cases are mounted on a stand or frame, so that they may lie before the person who is to select the types, and the little cells or boxes are so arranged that those containing the types most frequently used shall be nearest to the workman, who is technically styled a *compositor*. As will be easily conceived, the sizes of the boxes are made larger or smaller according as the types which they contain are more or less frequently required.

The types consist of the letters of the alphabet, of which there are three kinds—

Large capitals, A B C D E F G H I J K L M N O P Q R S T U V W X Y Z.

Small capitals, ABCDEFGHIJKLMNOPQRSTUVWXYZ.

Lower case, a b c d e f g h i j k l m n o p q r s t u v w x y z.

The above are Roman letters; we have the same in Italic, but in it small capitals are rare.

Large capitals, *A B C D E F G H I J K L M N O P Q R S T U V W X Y Z.*

Lower case, *a b c d e f g h i j k l m n o p q r s t u v w x y z.*

Besides these there are many varieties of letter used, such as Old English, and imitations of manuscript letters, the mention of which could only be serviceable to the practical printer. A collection of types, such as is necessary in ordinary circumstances for carrying on the printing of a work, is called a *font* or *fonte* (from the French *fonte*, a casting). A fonte must contain not only a sufficient number of letters, points, and figures, but likewise types to fill up spaces, and other peculiarities.

Types are of various sizes, the following being those commonly in use among British printers for regular book work:—English, Pica, Small Pica, Long Primer, Bourgeois, Brevier, Minion, Nonpareil, Pearl, Diamond. Of these various sizes we may give specimens, by printing a portion of the Lord's Prayer.

ENGLISH.

Our Father, which art in hea-

PICA.

Our Father, which art in heaven,

SMALL PICA.

Our Father, which art in heaven, Hallo-

LONG PRIMER.

Our Father, which art in heaven, Hallowed

BOURGEOIS.

Our Father, which art in heaven, Hallowed be

BREVIER.

Our Father, which art in heaven, Hallowed be thy

MINION.

Our Father, which art in heaven, Hallowed be thy name.

NONPAREIL.

Our Father, which art in heaven, Hallowed be thy name. Thy

PEARL.

Our Father, which art in heaven, Hallowed be thy name. Thy kingdom

DIAMOND.

Our Father, which art in heaven, Hallowed be thy name. Thy kingdom come. Thy will

The size of type used in printing this article is brevier.

Composing.—When a work is to be printed and the size of type and page determined upon, the copy is given to the compositor, who places it before him on the case, and lifts out the types in proper order, placing them in a little frame of metal which he holds in his left hand. This little frame is called the composing stick; one of its ends is movable, so that by means of a screw it may be fixed at a distance from the other equal to the breadth of the page. When one line of types has been put into the stick, the compositor continues the process of setting until the stick will not conveniently hold more. These are now carefully slipped out and slided on to a long flat board with a ledge, and the same process is continued until one or more pages has been completed. Any one seeing for the first time a compositor at his case must be struck with astonishment at the rapidity with which the experienced workman lifts the types from their respective boxes and places them in the stick, while at the same time so few errors are committed. In order to prevent the compositor from turning the type the wrong way, or to

prevent the letter from being inverted, a notch or nick is cut on the same side of each sort of types, which guides him to place it right.

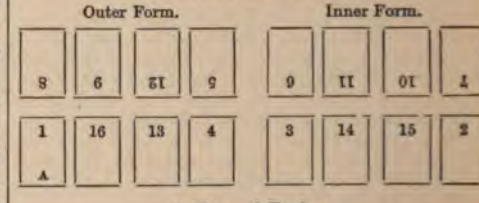
When a whole page has been composed, or *set*, as it is technically called, the workman binds the types together by tying a cord round them. This is done while the types are on the ledged board formerly spoken of, and which is usually called a *galley*. In some cases it becomes necessary that the author should see an impression or *proof* of several pages before they are tied up, in order that if anything is to be added or subtracted the compositor may be saved the trouble of untying and retying the pages; but when the necessary corrections have been made the types are tied in pages, as formerly mentioned. A sufficient number of pages having been composed in order to print one side of a sheet, an impression from them is taken and submitted first to the inspection of a corrector, who, by minute examination and comparison with the copy, endeavours to detect and point out by marginal references all the errors that the compositor may have committed. This is called the first reading of the proof; and when the compositor has gone over his page, and made the necessary alterations, a second impression is taken, called the *revise*, which is also inspected by the corrector. According to circumstances two or more revises are made; and when the corrector is satisfied the last revise is sent to the author to receive his corrections, which being attended to by the compositor, and examined by the corrector, the compositor's work is deemed fit for press. See CORRECTION OF THE PRESS.

The pages of a sheet or half sheet, after having been composed and tied up, are transferred to a large table of iron planed quite smooth. This table is furnished with drawers containing *furniture*, that is, materials for fixing the pages in the positions required for printing, consisting of wedges, called *quoins;* pieces of wood or metal, called *reglet*, &c., the use of which we shall presently describe.

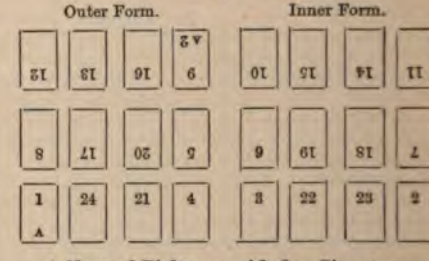
The compositor having laid down the pages of one side of the sheet on the table in proper order, proceeds to adjust them firmly in a rectangular frame of iron, called a *chase*, and the process of fixing the pages is called 'dressing the chase.' The chase being placed so as to begird the form, the next object is to keep the pages at a proper distance from each other, in order that a regular margin may be obtained. The pages are kept at the proper distances from each other by means of rectangular pieces of metal, called *gutters* or *gutter-sticks*, placed between them; and another species of furniture, called *reglets*, is placed in the crosses of the chase, so as to give the work to be printed a proper margin after it is bound. The interior portion of the form being now finished, the outer edges are next adjusted, by placing side sticks and foot sticks to them, and the whole is firmly secured within the chase, after being properly adjusted, by driving in wooden wedges or *quoins*. This last process is called locking up, but before it is done care is taken that all the types shall have their faces of one height, which is insured by placing over them a flat piece of wood, and striking it down with a wooden mallet.

The compositor must arrange the pages and fix them in the chase, in such order that when the impression is taken off, and the sheet folded, the pages will follow each other in proper order. There being two sides in a sheet, and eight or perhaps sixty-four pages on each side, some consideration is required to lay down the pages properly. On examining a printed sheet uncut, containing sixteen or thirty-six pages, this will appear at first sight a very intricate matter, and it must be owned that where the pages are numerous in a sheet the arrangement of the pages (called imposing) requires, even from the most experienced compositors, care and consideration. The process of imposing is, however, based upon a simple law, which, if applied, cannot fail to guard against mistakes in the arrangement of the pages. In a work like the present it would be completely out of place to enter into very minute details respecting this or any other branch of the process; but in order that the reader may see that there is a regular system or law observed in laying down the pages, we will subjoin plans of the pages of a sheet of 8vo, 12mo, and 18mo; that is, of sheets consisting of sixteen, twenty-four, and thirty-six pages. It must be premised, however, that the sheet being printed on both sides, that side which contains the first page of the sheet is called the outer form, and the other is called the inner form. In imposing the pages are of course laid down in positions the reverse of those they will take when printed.

A Sheet of Common Octavo.



A Sheet of Twelves.



A Sheet of Eighteens, with One Signature.

A little attention to the foregoing examples will

show that the order followed in the first is only extended in the more complex forms. It will be remarked that the pages go two by two, and that the numbers of these pages when added together always make one more than the number of the pages contained in the sheet. There being many sheets in some works, it would become a matter of great embarrassment for the person who folds them to be calculating the number of the page that should be the first in order while placing them together; in order to obviate which, letters (called signatures) are placed at the bottom of the leading page of each sheet, A for the first, B for the second, C for the third, and so on through the whole alphabet, and if that be exhausted a second alphabet is commenced. Thus, by merely looking at the signature the collator sees at once the proper place which the sheet should occupy in the book. The use of the letters of the alphabet for this purpose is now being superseded by figures, especially in extensive works, each sheet having a consecutive number, 1, 2, 3, &c.

As specified in the history of the art, printing was first performed by taking impressions from solid blocks, printing from movable types being a later invention, and decidedly a vast improvement. In more modern times a kind of junction of the two has proved of the greatest advantage, especially to some classes of publication. We refer to the invention of *stereotype* printing. Of this branch of the art it will only be necessary for us to give a brief outline here, as a detailed account will be found under our article STEREOTYPE PRINTING.

When the compositor has set up a page and tied it, as formerly described, it is fixed into a small chase or iron frame, after having been duly examined and corrected. A mould of gypsum or plaster of Paris is taken of the page, and a casting of the whole page is taken in type metal, the cast being one solid plate. The plates necessary to complete a form are locked in a chase, in a way similar to the movable type pages, and sent to press, the after process with both being the same.

Before we dismiss the consideration of the duty of the compositor, we must advert to a part of his business which follows that of the pressman. When the pressman has printed off all the impressions that are to be taken from a form of movable type, the chase is carried back to the composing room, and the compositor undoes the work that was formerly done, by distributing all the types, or putting them into their respective cells in the case. As much accuracy is required in the operation of distributing as in that of composing, for if a type be put into a wrong box, an error must necessarily be committed in composing again from the same case. Any confusion that may exist in the assemblage of types, arising from accident or carelessness, causes great trouble, and the types thus disarranged are called *Pie*.

A compositor ought to be intimately conversant with orthography, especially in distribution, as errors committed in spelling will throw the whole case into pie. The compositor should also be well versed in the rules of punctuation, as this is very commonly omitted by the author in his manuscript, or sometimes only partially attended to. Many persons would be apt to imagine that compositors must necessarily be possessed of a great deal of information, from their attentive perusal of works going through their hands on every variety of subject. The writer of this article has had numerous opportunities of comparing the intelligence of compositors with that of workmen engaged in other branches of industry, and from observation he has no hesitation in saying that compositors are above average; yet this arises not so much from their perusal of works while engaged in setting or composing, as from private reading; for while engaged at the case their attention is so much taken up with the mechanical part of the process, that the train of thought of the author can be little attended to; so that a historical work may be set up from beginning to end by a compositor, who at the termination could not show much intimacy regarding the subject of which it treated.

As before observed, when the form has been dressed and finished by the compositor, it is sent to the pressman, who fixes the chase in his press and adjusts it, so that a uniform and distinct impression may be taken off.

Composing Machines.—Several attempts have been made to expedite the work of the compositor by calling in the aid of machinery. These attempts have hitherto been only partially successful. A large portion of the compositor's work consists, as has been explained, in correcting the reader's and the author's proofs, in arranging the types in pages, in imposing these pages in forms, and in dressing the forms for press—all which processes are, in their nature, and from their variety, beyond the range of machinery. In that portion of his work again which does come within this range—namely, the processes of 'composing' and afterwards 'distributing' the types—so much of *mind* is required, that the machine, however excellent in itself, can never be regarded as anything else than a *help*, certainly not as a *substitute*. For composing newspapers, however, where the work is of the plainest description, and speed is of the first consequence, as also for a large proportion of book-work, it is very probable that machines may yet be extensively used. The main features of those which have yet been contrived are the same in almost all cases, and can be very readily understood. In their working the types are not lifted as by the fingers of the compositor, but are dropped. Horizontal channels, representing the boxes of the ordinary case, contain each a supply of a particular type, ranged or set up in a row in some order peculiar to the machine. Each of these channels is provided with an apparatus by which, on a simple touch of the finger of the operator or otherwise, a type can be liberated from the end of the row, when it immediately descends through a perpendicular or sloping channel to a common outlet, and drops into position in a contrivance equivalent to the compositor's 'stick.' This contrivance varies in different machines, but in none of them is the operation of 'spacing out the line,' or making it of uniform breadth, accomplished, this requiring to be done by hand.

It will be seen from this general sketch that the gain in machine over hand composing lies solely in the difference in time between the hand of the compositor travelling to different boxes, picking up a type, and placing it in proper position in his stick, and travelling to and simply touching the liberating contrivances, these externally being in general similar to the keys of a piano-forte. One of the main drawbacks to this gain is the necessity for previously ranging the types in order in the supply-channels, an operation which, when performed by hand, virtually amounts to a preliminary composing done in the ordinary manner in rows of separate letters. Various contrivances have been brought forward to enable the distribution to be made direct into the composing-machine channels, but no one of these has proved itself entirely efficient.

Mechanism of Printing.—The mechanism of letter-press printing, at first of the simplest possible kind, has made remarkable advances in recent years, having received the attention of some of the first inventors and mechanics. Three methods have been followed

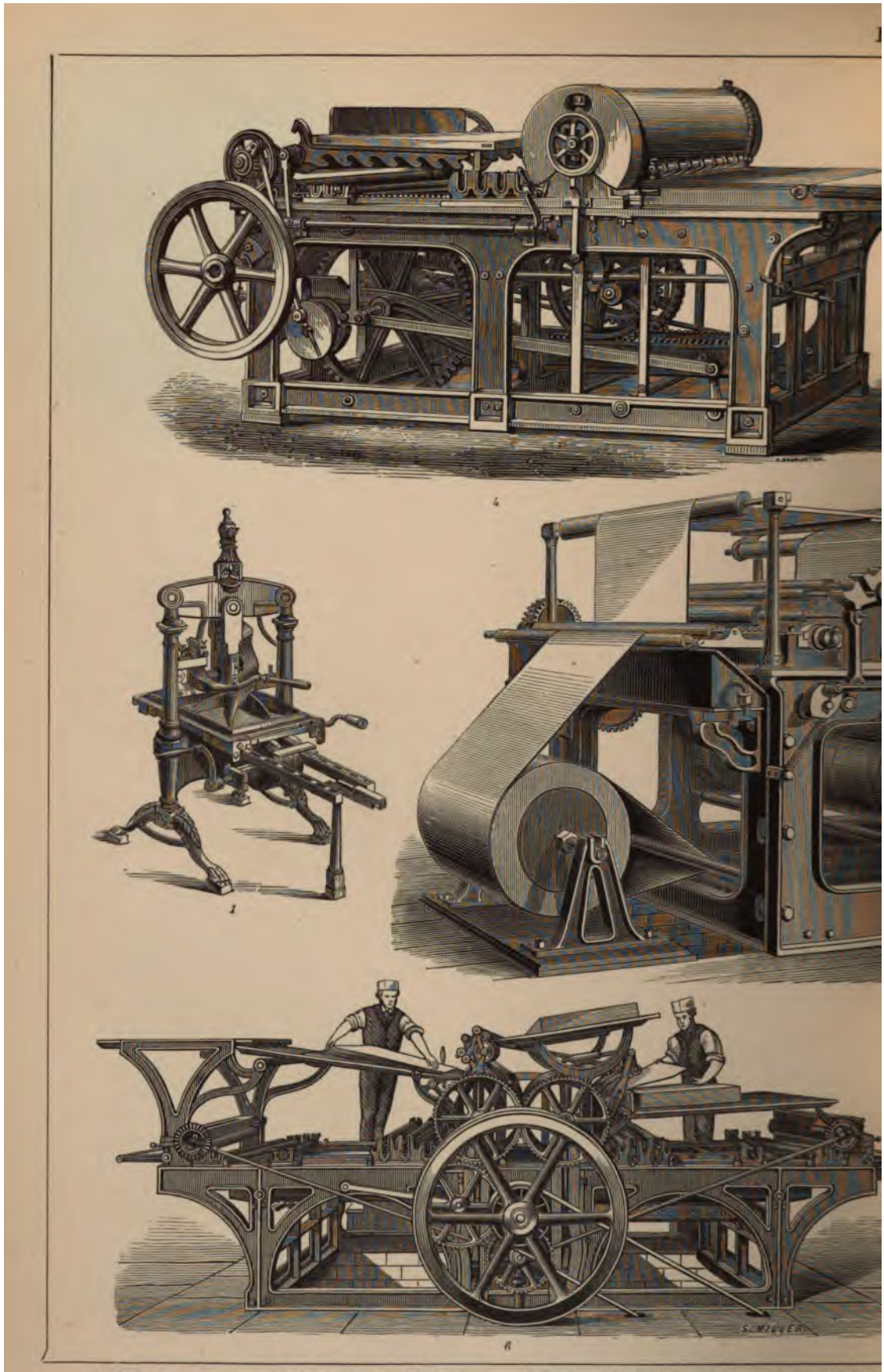
for obtaining the impression which produces the printed sheet. The first and simplest is by the advance against each other of two flat surfaces, one carrying the type-form and the other the blank sheet to be printed. Of this mode figs. 1 and 2 of Pl. CLXI.–CLXII. are examples. The second is by the rotation of a cylinder above a table which travels backwards and forwards, and which is in contact with the cylinder in advancing, but free in returning; the table in this case carries the types while the cylinder brings into contact with them the blank sheet. Figs. 3–6 are examples of this mode. The third and most recently adopted method is the contact of two cylinders constantly revolving in the same direction, one carrying the type-surface on its circumference, and the other bringing against it a continuous web of paper which is afterwards severed into sheets. Fig. 7 of the plate and the illustration on p 296 are examples of this class. The first mode has been designated the *platen* principle, the second the *cylinder*, and the third is coming to be known as the *rotary*.

The Hand-press.—It may be well to give, in connection with the hand-press, the details of the process of making ready and printing a form of types, a process common to all machines, with certain obvious modifications. The paper to be printed is damped with clean water before it is subjected to the action of the press, in order that it may be softened, and thus accommodate itself to the surface of the types. A few sheets are dipped in a trough of water and laid upon a board, a few dry sheets are laid over these, and then a few wet ones, and so on until the whole are piled up in a heap. They are then put into a common screw-press in order that the water may be pressed uniformly through them. The degree of damping will depend on the nature of the paper and other circumstances which experience alone can regulate. The pressman first lays the inner form on the press and prints one copy, which is called a *press revise;* this he takes to the person appointed to revise it, and while the revision is being done secures the form on the table of the press; takes the steps afterwards described as necessary to produce a uniform impression over all the pages; fixes the points, which make small holes in the paper that enable him to cause the pages to fall precisely on the back of each other when the second side of the paper is printed; and cuts his frisket, an iron frame filled in with paper, hinged so that it can be folded upon the blank sheet to cover it over, except the parts to be printed. When the revise is corrected he proceeds to ink the surface of the types by means of a roller, lays on them a blank sheet of paper, and places the two under the platen, the downward squeeze of which causes the ink on the types to adhere to the paper, and the latter is then withdrawn. After one side of the paper is thus printed to the required number the pressman lifts the form off the press, washes the ink off the face of the type with lye, and rinses it with water. He then proceeds in a similar manner with the outer form, thus completing the sheet. This process is continued sheet after sheet till the work is complete.

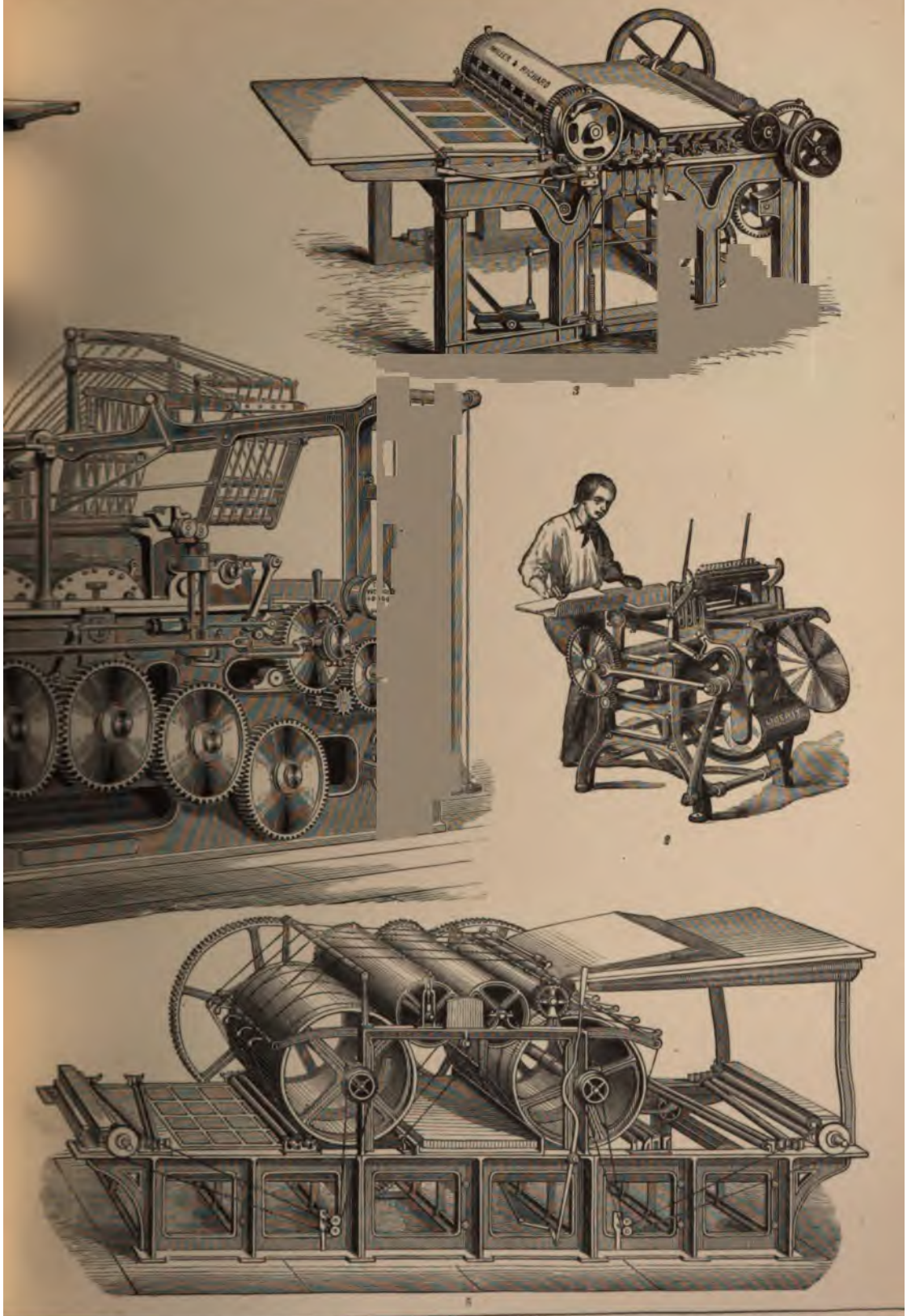
The first impression obtained is generally very irregular in depth—some parts of it may be heavy enough to go through the paper, while others can scarcely be seen. This is specially true of the first impression from stereotype plates, and arises from the fact that neither the plates themselves, the blocks of wood on which they are placed to bring them up to type-height, nor the blanket used to soften the impression on the types, are of equal thickness throughout, nor are even the planed faces of the iron carriage and platen perfectly flat. The plan adopted for remedying this defect, called *making ready*, forms perhaps the most important part of the pressman's duty, and in finer work and in woodcuts (where it serves an additional purpose) it often taxes his utmost skill. The process is commenced in the case of stereotype plates by placing pieces of thick paper between the plate and the block, to bear up the parts which are very low. When this has been done as completely as can be judged from the appearance of the first impression, a second impression is taken to show the result and to guide in further *underlaying*, as it is called. When the impression has thus been brought to a rough equality it is somewhat similar to the first impression obtained from a form of movable types, and the mode of procedure is changed. Pulling a sheet from the form, the pressman lays it on a cutting-board in a good light, with its bottom or rough side uppermost, so that the impression may be easily seen. He then with a sharp-pointed knife cuts away the parts of the paper that are too heavily impressed, and pastes pieces on those parts which are too light. The sheet being finished (now called a *skeleton*), is so placed in the press as to be exactly above the types when sheets are being printed. A second sheet for a skeleton is now pulled, showing the progress that has been made, and it is treated in precisely the same manner. The number of times which this is repeated depends mainly upon the *quality* of the work which it is intended to produce, varying from one to three, four, or even six sheets, the result being that the impression is perfectly regular, and supposing the types to get an equal amount of ink, the printed sheet shows but one shade of colour.

Making ready woodcuts, as already indicated, serves another purpose, and requires more skill and care. On glancing at an engraving, say a landscape view, it will be seen that some parts of it are light and open, such as clouds and objects in the distance, while others are heavy and black, as figures and buildings in the foreground. The amount of pressure necessary to bring up these latter parts would be very much too great for the former, making them coarse and blurred; besides that, with an equal impression it would be impossible to give the nice gradations of shade observable in a first-class engraving. It was formerly attempted to meet the requirements of the case by making the engraved surface of unequal height, those parts being lower which were wished printed light, the edges of others gradually sloping away till they quite disappeared. It is now found, however, that the same result can be more efficiently obtained in the making ready. A sheet is pulled from the block to be worked, and on the back of it is fixed by the corners several layers of paper, varying from three to six, according to the variety of light and shade in the subject. The workman then proceeds to cut away the layers of paper from certain parts, taking out one, two, three, or more layers as he wishes them made more or less light. This skeleton picture constitutes an *overlay*, and when finished it is placed in the same way as the skeleton; the sheet next pulled will obviously have more or less pressure according as the layers of paper have been more or less entirely cut away. This, however, is generally very far from sufficient, and to complete the making ready sheets are successively pulled and singly cut out in a similar manner until the desired result is obtained. An examination of some of the finer illustrated works which are constantly issuing from the press will show with what success this is done.

In former times the ink was put upon the types by means of two stuffed leather balls on which some ink was spread, a process which has been abandoned from its extreme tediousness. Instead of the balls



1. 'Albion' Hand-press. 2. 'Liberty' Platen Jobbing-press. 3. Single cylinder Jobbing-machine. 4. Single cylinde
sheet apparatus. 7. 'Victo



Book Machine. 5. Kirkcaldy Double-cylinder or Perfecting Book-machine. 6. French Double-cylinder Book-machine, with 'set-off' paper machine, with folding apparatus.

an elastic roller is now in general use. This roller derives its elasticity from a covering of a composition of treacle and glue. The ink is spread upon an iron table, from which a part is taken on to the roller and spread on the form of types every time the carriage of the press is drawn out. As division of labour expedites almost every process of art, so in this it is found advantageous to have two workmen engaged at the same time at one press, the one distributing the ink on the types, while the other is engaged in pulling the impressions.

The press used by Gutenberg was of a very rude description, and would appear to have been little better than a cheese-press. The pressure was obtained from a screw, but as this screw must have come down with a dead pull, there was great danger of injuring the types. The first improvement on this device seems to have been the construction of the ribs or tramway, on which the carriage was run, enabling the type-form to approach and withdraw rapidly from the impressing surface. Other necessities soon after arose, chiefly that of obtaining a rapid recoil of the platen from the type without the screw requiring to be turned round again; but it was not till the year 1620 that it was met by the invention of Willem Janszoon Blaeu, a native of Amsterdam. The peculiarity of this press was that the carriage holding the form was wound below the point of pressure, which was given by a handle attached to a screw hanging on a beam. Charles Mahon, the third earl of Stanhope, was the author of the next great improvement in printing-presses, about 1800. He devised a series of levers, which he applied to the old screw-press. These levers brought down the platen with greatly increased rapidity, and what was of still greater importance, converted at the proper moment that motion into pressure. The pressure was under great control, and capable of easy adjustment. The press was of iron, and not of wood, as was the case with all previously constructed presses, and it exhibited a number of contrivances of the most ingenious character for facilitating the work of the pressman. In 1813 John Ruthven, a printer of Edinburgh, patented a press on the lever principle, with several decided improvements.

The Columbian Press, invented in 1814 by G. Clymer, Philadelphia, was introduced into this country in 1818. In this press the power is obtained solely by a system of levers, without the intervention either of screws or inclined planes. It is reputed to be the most powerful of hand-presses, the workman being able to pull with it a heavy form with comparative ease. It is, however, defective in durability, several of its parts being liable to break even although manufactured with the greatest care.

The Albion press (Pl. CLXI.–CLXII. fig. 1) in its improved form combines the essential requisites of a printing-press—speed, easy pull, and durability in a high degree. The impression is given by means of what is called a knuckle-joint. In their normal condition the two parts of this joint lie at a slight angle to each other. When they are brought into line their entire length is consequently increased, and to that extent they are made to depress the platen. The return of the platen is effected by a strong helical spring inclosed in the central upright projection seen in the engraving.

The great labour required to work the hand-press, even in its most improved form, as also the slowness of the process, two workmen not being able to throw off more than 250 impressions an hour, rendered it desirable that some more expeditious and easy method of taking impressions from types should be obtained; and we are now about to draw the reader's attention to the progress and present state of the attempts that have been made to supersede the hand-press by the application of machinery.

Printing Machines.—So early as the year 1790 Mr. Nicholson took out letters-patent for printing by machinery. His plan consisted in forming the types with a tapering body or stalk, in order that they might be placed on the surface of a cylinder, and kept compact like the voussoirs of an arch. These types being placed on the surface of a cylinder, he distributed the ink by means of stuffed rollers or brushes. His printing-machine never became available in practice, yet he deserves the credit of being the first who suggested the application of cylinders and inking-rollers. About ten years subsequent to this period one König, a printer in Saxony, turned his attention to the improvement of the printing-press, with a view chiefly to accelerate its operation. By numerous experimental trials, and with the assistance of another German named Bauer, he at last produced a machine for printing, which, with modifications and improvements, stands, both with respect to ingenuity of mechanism and importance of application, in the first rank of the monuments of human intelligence. Being unsuccessful in all his applications to the printers and capitalists of his native country for assistance to bring his scheme into operation, he came to London in 1804. There he was for a considerable time received with equal coldness, until he met with Mr. Bensley, who had the sagacity to perceive and the boldness to adopt the views of the ingenious Saxon. Mr. Bensley and his copartner Mr. Taylor (a printing company in which the celebrated Woodfall had till a short time previous held a share) made numerous attempts to bring the machine into operation, and ultimately succeeded in completing a model, the action of which so satisfied Mr. Walter, proprietor of the Times newspaper, that an agreement was entered into to erect two machines to print that journal. These machines were accordingly erected, but so secret was the matter kept that the public knew nothing concerning it until, on the 28th of November, 1814, the reader of the Times was informed that he held in his hand a paper printed by machinery moved by the power of steam. This is commonly supposed to be the first specimen of printing executed by steam machinery; but a machine was set to work in April, 1811, and 3000 sheets of signature H of the Annual Register for 1810 were printed by it. This was undoubtedly the first work printed by machinery. The machine we are now speaking of was only capable of printing the sheet on one side, and the distribution of ink was unequal, the inking-rollers being covered with leather instead of the composition of glue and treacle formerly alluded to. These imperfections were rectified, and improved machines were offered for sale by Messrs. Bensley & Co. in 1817. This machine performed its work very well, and although it has given place to machines of a more simple construction in the minute detail, yet the leading principles are followed in the construction of the machines of modern date.

In fig. 5 of the plate we have given a view of the ordinary perfecting cylinder machine used in most book offices. It is moved by a steam-engine, the power being communicated by a belt passing round a pulley placed in the opposite side of the machine from that represented in our view. The machine requires the attendance of two boys, one to deliver the sheets to be printed, and the other to receive them after the impression. The feeding boy brings the edge of each sheet of blank paper between two systems of endless tapes at a point where they open to receive it; at a given instant these close, grip the sheet, and carry it into the machine. The endless tapes are adjusted so as to lie upon the sheet

on those parts only that are not to be acted on by the types, or in other words, the tapes touch only the margins and the divisions between the pages, in order that they may hold the paper during the whole of its progress through the machine. The use of these two systems of tapes is to keep the sheet in its proper position during the process, and thus to insure an accurate *register* or the exact placing back to back of the pages on both sides of the sheet. The most prominent parts of the machine are two large cylinders and two intermediate smaller cylinders, round which the systems of tapes which we have spoken of above pass, and carry with them the sheets of paper to be printed. These four cylinders revolve upon axes supported by the framework of the machine. The use of the intermediate cylinders is to effect the turning of the sheet, so that after an impression has been given on one side by one of the main cylinders, the other side may receive an impression by passing round the other main cylinder. When the sheet arrives at the bottom of the first main cylinder it comes into contact with the form of types lying upon the carriage. The sheet having thus received an impression, and being still held between the two systems of tapes, is carried upwards over the first intermediate cylinder, then under the second intermediate cylinder, and over a considerable portion of the upper part of the second main cylinder, proceeding round and under which it receives an impression from the second form seen to the left, about to pass under this cylinder. The sheet being now printed on both sides, must be freed by the tapes, and for this purpose the two systems separate and pursue different routes to the point where they commenced their joint action. The printed sheet is then received by an attendant boy on a table in the clear space in the centre of the machine.

Having now considered the simple yet ingenious manner in which the two systems of tapes are adjusted in order to procure an accurate register, a point of the highest importance, we shall next draw the reader's attention to the carriage before alluded to, on which the two forms of types are laid.

The carriage corresponds in office to the table of the common hand-press, being the bed or table upon which the forms of type are laid. The operation of the machine requires that it should have an alternating horizontal motion, which is obtained by mounting it upon castors or wheels that move upon two rails or guides firmly fixed to the frame of the machine. This reciprocating motion of the carriage is effected by a pinion turning in an endless rack below, the teeth of the pinion acting on the teeth of the upper part of the rack to drive it forward, and again on the teeth of the under part to cause it to return. This part of the apparatus cannot be represented in the engraving, but this is of the less consequence, as it is a contrivance well known to every mechanic as being one of the simplest and most effective methods of converting a continuous circular motion into a rectilinear alternating one. The rack apparatus is connected to the carriage by a simple arrangement of levers. The carriage thus moving alternately backwards and forwards carries the two forms of types (which are securely fixed upon it at a proper distance) alternately under the main cylinders, which give the impression. The adjustment of the two forms upon the carriage must be properly made, otherwise the register will be destroyed. It should be noted that about one-half of the diameter of each of the main cylinders is reduced about half an inch to allow of the free return of the type-form, which otherwise would print both going and coming.

By no means the least important or least ingenious department of the printing machine is the apparatus for furnishing and distributing the ink, performed by means of rollers covered with an elastic composition of treacle and glue, formerly alluded to, of which there is a set at each end of the machine, corresponding with the two tables and the two forms of types. From the ink duct at either extremity of the machine, in which a metal roller is continually revolving, a vibrating roller delivers on the table a regulated quantity of ink each time it arrives at either end of the machine. This ink is distributed upon the table by means of rollers which are moved wholly by friction, and is taken from the table and delivered to the types by the furnishing rollers, close to the main cylinders, each time the form of types passes under them. Machines such as the one described will throw off 1000 to 1200 sheets per hour, printed upon both sides.

Several machines having the same general construction, but improved and adapted for special purposes, have been constructed, and are in general use. The one represented in fig. 6, Pl. CLXI.–CLXII., is a French contrivance, and produces a much finer quality of work than the former. Its cylinders are smaller in diameter, and make two revolutions for each sheet printed, provision being made by slightly raising them alternately to allow of the return of the types. No tapes are used; instead of them a set of metal fingers in a longitudinal opening in the first cylinder open and grasp the sheet held out for them by the attendant on the left; and they, after the sheet has been printed on the one side, open and deliver it to a similar set of grippers on the second cylinder; which again, when it is perfected or printed on the second side, open and throw it to the attendant on the right. One valuable feature of this machine is that it allows of a 'set-off sheet' being used, that is, of a sheet going into the machine so that it shall fall between the second cylinder and the sheet just printed at the first, in order to receive the ink which to some extent comes off from the first printed side, and which would otherwise accumulate on the surface of the cylinder and smear all succeeding sheets. The attendants who work this set-off sheet are not shown in the engraving.

The machines shown in figs. 3 and 4 are essentially of the same class as the last, but have only one cylinder. They are used mainly for miscellaneous or 'jobbing' printing, though both are capable of giving very good book-work, the sheet in that case having to be 'turned' or put through again to print the second side. The machine shown in fig. 3 is constructed on a principle which, in specially securing a steady parallel action of the table, combines ease of movement with freedom from liability to shake.

Machines on a plan similar to the perfecting arrangement just described are constructed for newspapers of the smaller size and moderate circulation. They are made with two or four cylinders, each of which prints a copy of one side of a paper at each travel of the type-table, two or four boys being employed to feed simultaneously. In this way are printed 1500, 2000, or 5000 copies per hour. This process has to be repeated to print the second side.

The enormous increase in the circulation of the Times newspaper, demanding a corresponding increase in the speed of production, a further improvement was made in May, 1848, by the adoption of a new machine constructed by Applegath, which threw off 10,000 impressions per hour. This machine was a vertical cylinder 65 inches broad, on which the type was fixed, surrounded by eight other cylinders, each about 13 inches diameter, and covered with cloth, round which the paper was led by tapes, each paper or impression cylinder having a feeding apparatus

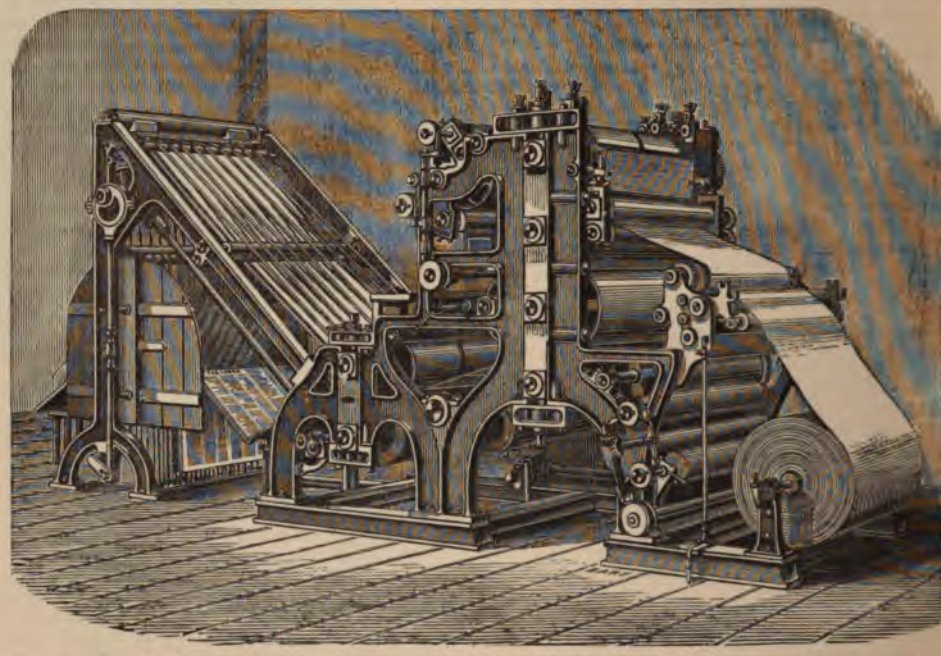
and two boys tending. The ink-rollers were also vertical, against the large cylinder, on which they distributed the ink. This last was in a vertical cylinder. The type used was the ordinary kind, and the form was placed on a portion of the large cylinder. The surface of the type formed a portion of a polygon, and the regularity of the impression was obtained by pasting slips of paper on the impression cylinders.

Few machines, however, of this construction have been made, a formidable rival having appeared, made by Messrs. Hoe & Co. of New York, which has been introduced into many newspaper offices in this country. It is called 'The Type Revolving Fast Printing Machine,' and is made with from two to ten impression cylinders. A horizontal cylinder of about 6½ feet in diameter is mounted on a shaft with appropriate bearings; about one-sixth of the circumference of this cylinder constitutes the bed of the press, which is adapted to receive the form of types; the remainder is used as a cylindrical distributing table. The diameter of the cylinder is less than that of the form of types, in order that the distributing portion of it may pass the impression cylinders without touching. The ink is contained in a fountain placed beneath the large cylinder, from which it is taken by a ducter roller, and transferred by a vibrating distributing roller to the cylindrical distributing table; the fountain roller receives a slow and continuous rotary motion to carry up the ink from the fountain. The large cylinder being put in motion, the form of types thereon is in succession carried to each of the six corresponding horizontal impression cylinders, arranged at proper distances around it, to give the impression to six sheets, one introduced by each impression cylinder. The fly and feed boards of two of the impression cylinders are similar to those on the well-known double-cylinder press; on the other four the sheet is fed in below and thrown out above. The sheets are taken directly from the feed-board by iron fingers attached to each impression cylinder. Between each two of the impression cylinders there are two inking rollers, which vibrate on the distributing surface while taking a supply of ink, and at the proper time are caused to rise by a cam, so as to pass over the form, when they again fall to the distributing surface. Each page is locked up upon a detached segment of the large cylinder, called by the compositors a 'turtle,' and this constitutes the bed and chase. The column-rules run parallel with the shafts of the cylinder, and are consequently straight; while the head, advertising, and dash rules are in the form of segments of a circle. A cross-section of the column-rules would present the form of a wedge with the small end pointing to the centre of the cylinder, so as to bind the types near the top; for the types being parallel instead of radiating from the centre, it is obvious that if the column-rules were also parallel, they must stand apart at the top, no matter how tight they were pressed together at the base; but with these wedge-shaped column-rules, which are held down to the bed or 'turtle' by tongues projecting at intervals along their length, and sliding in rebated grooves cut crosswise in the face of the bed, the space in the grooves between the column-rules being filled with sliding blocks of metal accurately fitted, the outer surface level with the surface of the bed, the ends next the column-rules being cut away underneath to receive a projection on the sides of the tongues, and screws at the end and side of each page to lock them together, the types are as secure on this cylinder as they can be on the old flat bed. A very large machine upon this principle was made for the Times newspaper by Whitworth of Manchester, and put in operation in July, 1859. It had ten impression rollers, and consequently required ten men to feed in the paper. It threw off at the rate of 18,000 impressions per hour.

Repeated attempts have been made by various inventors to construct a machine which would print from the continuous roll or web in which paper is supplied by the paper-making machine. Experiments were conducted successively by Nicholson, Stanhope, Sir Rowland Hill, Applegath, and others, but the difficulties for the time proved insurmountable. These, however, have at length been wholly overcome, and the result is the construction of a class of machines which possess the merit of being at once simpler, more expeditious, of producing better work, and being more economical in requiring less expenditure of manual labour than any previous contrivance. In all machines printing separate sheets their speed was governed by the dexterity of the layer-on, and thirty to thirty-two sheets per minute was the utmost that he could feed in. To produce large numbers it was necessary to multiply the impression cylinders, as in the Hoe machines already mentioned; but when four or six cylinders are reached the complications become very great. The stoppages are frequent, the waste excessive, and the risk of accident to the machine and material very formidable; moreover, the expense of working these machines is very great. A machine working from the roll is independent of manual dexterity, and is regulated solely by the mechanical apparatus.

The first machine on this principle that established itself in the printing-office was the 'Bullock,' an American contrivance. It was, however, speedily eclipsed by the 'Walter Press,' a machine invented and constructed on the premises of the London Times. These were shortly followed by the 'Victory' (fig. 7, Pl. CLXI.-CLXII.), which delivers the newspapers folded for the trade; the 'Prestonian,' and the 'Northumbrian,' which is adapted to print from movable types as well as from stereotype casts —all the others being able to print only from the latter. This feature of the 'Northumbrian' is, for newspapers of comparatively moderate circulation, of great economic importance. Besides these the 'Hoe' and the 'Marinoni,' a French double-cylinder previously in general use, have both been altered to work on the web plan, thus distinctly proving its superiority. As much from its origin and connection as from its intrinsic merits, the 'Walter' has come more prominently before the public than its competitors, and may be taken as the type of the class. The woodcut on next page will give a good notion of its general appearance. In it 'a web of paper, making some 5500 sheets of the Times, all wound on one reel, is placed behind, and when printing commences the paper runs continuously through the press, passing first over some wet rollers which damp it, water continually oozing out through folds of cloth from a supply contained inside the rollers, and which rapidity of revolution forces outward. From these rollers it goes upward to where the stereotype plates forming the four pages of one side of a sheet of the paper are fastened on a cylinder just large enough to take a sheet to go round it. Against that cylinder there is another identical in size, possessing a soft surface, which presses lightly against the surface of the type, and between these the sheet passes, taking up an impression in its course. It is then carried downwards round another large cylinder covered with cloth, the "set-off" on which is taken off by another cylinder in contact with it, and that again by a rubber in a fashion that is both simple and effective. The web of paper, still running on, passes between the second type-covered roller and its counterpart, taking the impression on its other side of the remaining four pages; and that done, it runs on between two more

rollers of the same circumference, one of which contains a notch, and the other a serrated knife with a spring-pressed bar running along each side of it. The machinery is so adjusted that the knife catches the paper exactly between each sheet, and the paper being held hard on each side by the spring-bar, cuts it in two all but a couple of tags near each end, which are left for the purpose of pulling the sheet on



between two sets of running tapes, until it is caught by a pair of small rollers which are driven at a greater speed than the rest of the machine. These immediately tear the sheets apart where they have been all but cut, and the tapes lead on what is now a completely printed newspaper up an inclined plane, at the top of which they carry it down an oscillating frame, which moves in such wise that it delivers a paper precisely at each end of its short swing on to the face of another set of running tapes, which carry it downwards on their outer face by the mere force of contact as they run. Between these tapes a frame swings backwards and forwards, catching up one delivered paper at every motion, and flinging it down on a board, behind which a boy sits to watch and adjust the sheets as they fall.' The machine pumps up its own ink from a tank beneath the floor, preparatory to the distribution by the inking rollers. Two boys and the man who attends it furnish all the manual labour required for the working of the machine. At the Scotsman office, which uses two Walter presses, the Friday's daily issue and the weekly issue are printed on the same day, when 80 miles of paper are printed off in little more than four hours. A slightly modified form of the Walter machine was successfully employed at Vienna for printing the catalogues of the Exhibition of 1873. This was the first instance in which it was used on the Continent, and the catalogue is the first book printed from a continuous roll of paper. The invention of the Walter machine is due mainly to the combined ingenuity of Mr. Walter, chief proprietor; Mr. Macdonald, manager; and Mr. Calverly, chief engineer of the Times newspaper. The experiments, inventions, combinations, and tests occupied from 1862 to 1868, in which year one machine was finished. Since 1869 four of these have been in operation in the Times office, by means of which that paper has been wholly printed in less than half the time previously occupied, with one-fifth the number of hands required for the Hoe machines, a reduction in the number of inking-rollers and blankets, less ink, and a less waste of paper.

Platen Printing-machines.—The machines hitherto described have been of the cylinder class and of the outcome of that class—the rotary. It only remains to notice the platen or flat-surface printing-machine. This was contrived soon after the introduction of the cylinder, and had for its aim the production of work equal in quality to that produced by the hand-press, and at a much greater speed. It has assumed different shapes in the hands of different makers, but as manufactured in this country requires two persons to lay on or feed in the paper, and two to take it off, each pair producing at the rate of 1000 to 1200 impressions each hour. It is constructed upon the same principles as the hand-press so far as the mode of taking the impression is concerned, but is distinguished from that press in that it automatically inks the form, runs in the carriage, brings down the platen and recovers it, and runs out the carriage, the tympan being lifted by attendants, who remove the sheet and replace it with another, and then turn down the tympan, leaving the machine to go through its motions over again. The great improvements recently made on cylinder machines, especially of the 'French' class, having made them capable of producing work of the finest quality, the platen is gradually disappearing.

The platen method is also used in the small jobbing machines, which are of quite recent introduction. They are sometimes worked by a treadle; they perform the whole of the operation of printing, the attendant having simply to lay the paper to be printed to a gauge, and remove the printed sheet, while keeping the treadle in motion. See Pl. fig. 2.

Warehousing.—The printed sheets are conveyed from the press or machine to the warehouse. Here they are first of all hung on long horizontal poles, and exposed to the air for some time, for the purpose of fixing the ink as well as for extracting the moisture from the paper. When dry they are placed singly between sheets of highly glazed pasteboard, and then subjected to very great pressure in a Bramah press, by which means the roughness consequent on the impression of the types is entirely removed, and the surface of the paper generally smoothed down. After coming from the Bramah press the sheets are counted, parcelled up, and finally handed over to the bookbinder. It will be obvious that very much of the appearance of the completed volume depends upon the careful manner in which the warehousing is done, it being professedly the *finishing* part of the whole process of letter-press printing. Hand-labour has now to some extent given place to machinery in this department of the work. Where this is the case the sheets are passed singly between two highly-polished cylinders of chilled iron heated by steam, thus at once drying the paper and ink, and giving a very high 'finish.'

Copperplate Printing.—In our article ENGRAVING a minute account has been given of the process by which subjects are engraved upon plates of copper or steel. The process of printing from them, though in some respects analogous to that of letter-press printing, yet in many essential particulars differs from it. While in letter-press printing it is the *raised* surfaces of the types which give the impression, in copperplate printing it is the hollow scooped-out lines that perform that office.

The workman having previously damped and prepared the paper, which is of a soft bibulous texture, places the plate or engraving from which the impressions are to be taken on a small stove or heater with which he is supplied. After being sufficiently warm to assist the ink in finding its way into the fine incised lines, he daubs the whole surface of the plate with ink composed of Frankfort black and boiled oil of the consistency of thick paste. The ink being well rubbed into the lines, he proceeds to clean the plate by wiping off the ink from the raised surface, taking care not to wipe any of it out of the lines, and polishing the margins with whiting. When fully ready he lays the plate upon the flat table of a rolling press, wrought by hand, and places over it the piece of paper which is to receive the impression; then by bringing the press into action, he moves the table along between two metal rollers, thereby subjecting the plate to a sharp pressure, which throws the ink from the hollow lines on to the paper, and thus produces the impression desired. The upper metal roller is covered with several thicknesses of soft blanketing specially manufactured for this purpose. By this means the paper is forced down into the engraved parts with a firm soft pressure, and the plate itself is preserved from injury. The process of inking, &c., is repeated as already described for each impression required; consequently the operation is slow.

From a small well-engraved plate a workman will produce 500 impressions in a day. As the plate increases in size, and as the quality of the engraving is of a higher description, the number produced decreases. Many large engravings, such as those distributed by the Art Unions, cannot be produced more rapidly than four each hour, and some even still more slowly. Steam machinery has not yet been brought to bear upon the process of copperplate printing, and indeed, from the nature of the operations performed by the workman, they do not appear likely to be successfully accomplished by any mechanical apparatus.

The process of finishing is exceedingly simple, consisting chiefly in placing the moist printed impressions between smooth absorbent mill-boards, and subjecting them there to a slight pressure. When relieved they are examined, cleaned if necessary, and are then ready for sale.

PRINTING, LITHOGRAPHIC. See LITHOGRAPHY.

PRINTING, NATURE. See NATURE-PRINTING.

PRIOR was the title formerly given to the head of a small monastery, to which the designation of priory was applied. The prior ranked next in position to the abbot. Similarly the term *prioress* was applied to the head of a female convent. The title of *grand prior* was given to the commandants of the grand military priories of the orders of St. John of Jerusalem, of Malta, and of the Templars.

PRIOR, MATTHEW, an English poet and diplomatist, born in 1644, at Wimborne, in Dorsetshire, or at Winburn, in Middlesex. His father dying when he was young, he was brought up by an uncle, who kept the Rummer Tavern at Charing Cross, and was by him sent to Westminster School. He early imbibed a strong taste for classical literature, and attracted the notice of the Earl of Dorset, through whose good offices he was enabled to enter, in 1682, St. John's College, Cambridge, where he graduated as B.A. in 1686, and was shortly after chosen fellow. At college he contracted an intimacy with Charles Montagu, afterwards Earl of Halifax, in concert with whom, in 1687, he composed the Country Mouse and City Mouse—a parody on Dryden's Hind and Panther. In 1690 he was introduced at court by the Earl of Dorset, at whose recommendation he was appointed secretary to the English plenipotentiaries at the Hague. With this post he also held the title of gentleman of the king's bed-chamber. In 1695 he presented an ode to King William, on the death of Queen Mary, and soon after displayed his humorous vein in a parody on Boileau's ode on the taking of Namur, when it was recaptured by William. In 1697 he was nominated secretary to the commissioners who concluded the Peace of Ryswick, and on his return from that employment was made secretary to the Lord-lieutenant of Ireland. He was afterwards secretary to the Earls of Portland and Jersey, successively ambassadors to France. At length he was made under-secretary of state, and while holding that office was sent to France to assist in the partition treaty. In 1701 he entered Parliament, and in the same year succeeded Locke as a commissioner at the board of trade, but soon after joined the Tory party. At the beginning of the reign of Anne he published a volume of poems, and took some share in the Examiner. In 1711, when the Tories again obtained the ascendency, he was employed in secretly negotiating at Paris the terms of the Treaty of Utrecht. He remained in France, with the appointment of ambassador, and after the departure of the Duke of Shrewsbury, in 1713, publicly assumed that character. On the accession of George I., in the following year, when the Whigs were once more in power, Prior was recalled and examined before the privy-council in respect to his share in negotiating the Treaty of Utrecht, and treated with great rigour, being kept in custody on a charge of high treason for two years, although ultimately discharged without trial. Being without any provision for his declining years, except his fellowship, he again applied himself to poetry; and having finished his Solomon, he published his poems by subscription. The publication being liberally encouraged by party zeal, produced a considerable sum, which was doubled by the Earl of Oxford, at whose seat the author died, after a lingering illness, in 1721, in the fifty-eighth year of his age. He was interred

in Westminster Abbey, under a monument, for which 'last piece of human vanity,' as he styles it in his will, he left the sum of £500. Prior seems to have made his way by wit and social qualities, rather than by moral or political endowments of a superior order. He is said to have always retained a taste for coarse intercourse and gross enjoyments. As a poet, his reputation has declined of late years, the humour in which he principally excels being overlooked on account of the character of his serious performances, which, although, as in his Solomon, and Henry and Emma, splendid and correct in diction, harmonious in versification, and copious in poetical imagery, fail in moving either the feelings or the fancy. The great art of Prior consists in telling a story with a degree of poetical ease and vivacity, which, perhaps, setting aside La Fontaine, has never been excelled. His Alma, a piece of philosophical pleasantry, exhibits a felicitous vein of humour; and for his lighter pieces he is now chiefly read. A History of the Transactions of his Own Times, compiled from his MSS., contains little from his pen, and is of small value. His poems were published in 1733, in three vols. 8vo, and are also to be found in all the standard collections of English poetry.

PRISCIANUS, a celebrated Roman grammarian, who lived in the latter half of the fifth century of our era, and of whom little more is known than that he was born at Cæsarea, taught grammar at Constantinople in the time of Justinian, and wrote various works, of which several are still extant. Profoundly conversant with the Latin and Greek languages, as well as with the investigations of previous grammarians, he was enabled to enter better than his predecessors into the grammatical peculiarities of the Latin tongue. He arranged his observations upon this subject in a work entitled Commentariorum grammaticorum lib. xvii. This work, successively abridged by several writers, formed the basis of instruction in Latin up to the fifteenth century. It contains numerous quotations from Latin authors now lost. It is the best treatise on the subject bequeathed to us by antiquity, and it furnished the materials for most of the Latin grammars compiled at the revival of letters, has gone through many editions, and may still be consulted with profit.

PRISCILLIAN, the founder of a Gnostic sect in Spain, known as Priscillianists, in the middle of the fourth century, gained over by his eloquence even some bishops to his system, compounded of dualism, the theory of emanations, and astrology, and resembling very much the doctrine of the Manichæans. He taught that the soul was of the same substance as God, and admitted an evil principle as author of the world, without, however, rejecting the Old Testament, which he interpreted allegorically. He was excommunicated by a synod at Cæsar-Augusta (Saragossa) in 380, but managed, by means of bribery, to get the decision reversed, and obliged his chief enemy, Bishop Ithacius, of Ossonuba, to take flight. The bishop, however, succeeded in gaining over Maximus, the usurper at Treves, to his side, and thus obtained the condemnation of the Priscillianists, as well as of their leader, who, in spite of an appeal to Maximus, was executed at Treves in 385. This is said to have been the first instance in which a heretic was punished with death, and was protested against by Martin of Tours, Ambrose, and other bishops. The sect maintained itself in the face of persecution, and perhaps the more successfully that lying and dissimulation were regarded as lawful means of propagating it.

PRISM, in geometry, a solid figure which might be generated by the motion of a line kept parallel to itself, one extremity of it being carried round a rectilinear figure. A 'right prism' is a solid figure bounded by two parallel equal and similar ends, and by a number of plane faces which are at right angles to the ends. In optics a prism is any portion of a medium lying between two plane faces which are not parallel. Prisms of glass are always true geometrical prisms, their sections being triangles, either right-angled, equilateral, or isosceles. The two latter kinds are usually employed in the prismatic decomposition of light. The right-angled prism is used as

a reflector. The figure shows a glass prism mounted in the usual way on a stand which has three joints. We have also 'prismatic lenses,' 'double-image prism,' 'Nichol's prism,' 'inverting prism,' 'liquid prisms' of various kinds, &c.

PRISON DISCIPLINE. The true and only real object of punishment is the prevention of crime. There is, of course, a great latitude of choice in the means which may be adopted for the attainment of this object—a latitude to be limited by a just regard to the rights inseparable from human nature, however depraved, by a correct view of the true power of society over its members, and by a wise estimate of the probable effect of the means employed. In most ages of the world men seem to have imagined their rightful power over their fellowmen absolutely unlimited, and have inflicted punishment upon the violators of the law apparently without regard to any other consideration than their own pleasure, and the degree of guilt they have attributed to the offender. Acting with this apprehension of their own unrestricted power, they have, at the same time, exhibited the most narrow acquaintance with the almost infinite variety of means of punishment. They have confined themselves very much to the effects of physical suffering, as if that were the sole remedy which could be advantageously applied to moral depravity; a depravity often increased, if not caused, by the temptations to which physical suffering has itself exposed men. It has happened too, in this, as in so many other human pursuits, that the end has been forgotten in attention to the means; and the object has appeared to be rather secretly to harass and oppress the subjects of punishment, than either to deter others from the commission of crime, or to amend the habits of the guilty themselves. None would be prevented from the commission of

crime by penalties which were unknown, and in the extreme depression of every physical and mental quality, it were absurd to expect any reformation of the unfortunate subjects of human severity. In all ages and nations of which we have any record, from the most refined people of ancient times to the most civilized of a more modern era, have such extremes of severity been used in the punishment of criminals as justly to deserve the appellation of *cruelty*. Torture in every horrible variety; chains, stripes; solitary confinement in darkness, dampness, and idleness; promiscuous crowding of offenders of every degree of guilt in the same loathsome, pestilential, narrow vaults; insufficient and unwholesome food; filth; illness of the body, and sickness of the soul—are some of the evils which have, in every age, been wantonly, carelessly, or ignorantly inflicted upon the violators of law; and what is worse, they have been inflicted upon those who have violated no law; upon many who have been proved innocent after suffering the infliction of some or all of the ills enumerated in this atrocious catalogue, and upon many whose imprudence alone has exposed them to the vengeance of an equally imprudent creditor. Society has, unquestionably, a right to punish the offenders against its laws, and against those of God; but has it, under any circumstances, a right to inflict such suffering as we have named? Has it a right to trifle with or endanger the health, the intellect, or the remaining principles of any, even the worst, of its members? It requires no metaphysical examination of the reasons on which the just and necessary power of society is founded, to answer in the negative. All feel that the proper adaptation of the means to the just end of punishment ought to be constantly kept in view. A striking illustration of the truth of this remark may be found in the universal outcry of horror and indignation which was heard throughout the civilized world when Howard disclosed the misery everywhere suffered by the prisoner; in the guilty consciousness with which those who exercised control over prisons universally shrunk from the disclosure of the atrocities committed under their authority, or at best allowed by their negligence; and in the immediate formation of associations to promote the necessary reform in the construction and government of prisons. From the year 1777, when Howard's work on the state of the prisons in England and Wales was first published, may be dated the origin of the study of the best system of prison discipline. There were, indeed, previous noble examples of attention to those who were sick and in prison, but it then became a subject of general interest. The effect of Christianity in softening the character, and ameliorating the condition of men, had been perceptible even in the treatment of the culprit; and from time to time there had arisen in the world men distinguished for the kindness they exhibited to those to whom kindness was almost unknown. The names of Carlo Borromeo, Claudius Bernard, and St. Vincent de Paul, ought never to be forgotten among those who have shown mercy to the captive. But Howard deserves still greater veneration for his persevering philanthropy and entire devotion to his noble object. The sphere of his exertions was not limited to his immediate neighbourhood, but extended first throughout his native land, afterwards to adjoining kingdoms, and embraced at length the whole of Europe.

Nothing more was necessary than to witness the state of abject misery existing in prisons, in order to perceive the necessary remedy in many cases. Thus the evils arising from crowded and filthy rooms, and from want of circulation of air, could be prevented only by a better construction of the buildings; while those arising from the exaction of fees from the prisoner, and from the sale of liquors by the officers, could be remedied only by a new system of discipline. Many of the ideas, therefore, which have been since acted upon in the construction and government of prisons, were suggested by Howard, while experience has produced some improvements in his plans. It cannot be said that any regular system of prison discipline was introduced by Howard; nor has it even yet been carried to the perfection which may reasonably be expected, but the progress already made affords the greatest encouragement. It would not be easy to trace this progress with exactness, assigning to each labourer in the cause his due share of merit; nor is it necessary, for there is no great difficulty in discovering the general remedies for the various evils of imprisonment. The essential requisites in a prison are obviously security of construction and healthiness of situation; and in its management, classification, oversight, labour, and instruction. It is in the previous arrangements for securing these advantages, and in the practical application of these general principles, that the difficulties lie; and so numerous are these difficulties that great diversities of feeling and opinion have arisen, and very few have been found to agree in the details for carrying into effect a general system. The very first attempt in England to introduce a practical reform in the construction and management of prisons failed for want of unanimity in the commissioners appointed by Parliament as to the location of the new establishment, though Howard himself was one of the board. By a law passed in 1835 inspectors of prisons were appointed, and since 1839 no new prison can be used till sanctioned by the government. An act of 1865 (28 and 29 Vict. cap. cxxvi.) consolidated and amended the law in relation to the maintenance, government, discipline, enlargement, and rebuilding of prisons. This act abolishes distinctions between jail and house of correction. Cap. lxxxiv. of the same act regulates Scottish prisons.

At the very time when Howard was devoting every power of his mind and body to the discovery and disclosure of the evils of imprisonment, the Society of Friends in Philadelphia, acting on the principles of the wise and benevolent founder of their sect, were endeavouring to abolish the use of some of the cruel and injudicious modes of punishment then practised (such as the pillory, the scourge, &c.), and to substitute for them, as well as for capital punishment, the milder and, as they believed it would prove, more efficacious measure of solitary imprisonment without occupation or intercourse with any person. In pursuance of this scheme the prison in Walnut Street, Philadelphia, was built, and others on the same principle were speedily erected in other parts of the United States, among which may be mentioned more especially the celebrated prison at Auburn, in the state of New York. The solitary system of imprisonment was here carried out with the utmost rigour, the prisoners being confined in separate cells, only 7 feet long by 3½ feet in breadth, and 7 feet in height. While immured in one of these the inmate was never allowed for a moment to quit the cell, to hold intercourse with any one, or even to see the attendant warder. The supply of food and water, and the removal of refuse, were effected by machinery, without the intervention apparently of any human agent. Such a course of discipline proved in the end eminently unsuitable, and had to be abandoned, owing to the disastrous consequences which in many instances ensued. The health of the prisoners was frequently irreparably injured, insanity supervened in many cases, and in a prison in the state of Maine, where the cells were constructed in

the form of pits, with an iron grating at the top in the form of a trap-door, several of the prisoners committed suicide to escape from the horrors of their situation. The solitary system having thus, in a great measure, proved a failure in America, the invention of social legislators was again set on the rack to devise some equally effectual means of punishment without such objectionable adjuncts, and the second great experiment in prison discipline—the silent system—was accordingly instituted. The principal establishment where this system was carried out to its utmost extent was the penitentiary of Sing Sing in the state of New York. The prisoners were still, as at Auburn, confined to separate cells during the night, but in the daytime were conducted out to large rooms where they worked together, but without being allowed to exchange a single word, or so much as a single glance, with any of their companions. Throughout the whole period that they worked together in their common compartment, as well as during and after their return to their cells, this system of sepulchral silence was rigidly maintained. Any transgression of these rules was followed by the immediate infliction of corporal punishment in the shape of whipping, and this penalty was equally incurred by the prisoner speaking to one of his fellow-prisoners, or to a stranger visiting the prison. To insure the efficacy and promptitude of the punishment, the humblest officer in charge of the prisoners had necessarily to be intrusted with the power of administering it, and no appeal was allowed to the prisoners against the acts of any official. Such an irresponsible authority must doubtless, in many instances, have been liable to be grossly abused, and so much more so from the impossibility of arriving at the truth of any charge brought against an officer of the prison in the case of an investigation being made. It has also been argued that the restraints imposed under the silent system must, in the end, prove as injurious to the minds of those subjected to it as the consequences resulting from isolated confinement under the solitary system. But perhaps one of the most effectual arguments against the silent method is to be found in the fact, that even under the most rigid restraint, such as that maintained in the prison of Sing Sing, enforced by the prompt application of severe corporal chastisement, it was found impossible to prevent the prisoners exchanging communications with each other by means of signs. This circumstance was strikingly evinced by the discovery of the acquaintance of the prisoners with facts supposed to be quite beyond their possible knowledge—so impossible is it effectually to debar men by restrictive enactments from the exercise of any faculty or the indulgence of any propensity to which they are prompted by the instincts of their nature. From a consciousness of its comparative inefficacy the silent system has in consequence undergone a considerable modification in American prisons.

The third great improvement in prison discipline—the labour system—is what is now generally pursued in this country, with the combination, in certain cases, of the separate system. Nothing could be more demoralizing than the old system of imprisonment, under which numbers of men were herded together, it might be for months, without occupation of any kind, and exposed to all the corrupting influences of so promiscuous and degraded a society. Can it be wondered at that a man subjected to such evil communications, the danger of which would be infinitely increased in proportion to his youth, emerged from prison at the term of his sentence a hardened criminal, with all good aspirations and intentions of reform, which he might otherwise have cherished, completely extinguished. It has accordingly been the object of modern legislators to keep the prisoners actively employed, both for the beneficial results, morally and physically, to the parties occupied, and also with the view of rendering prisoners to a certain extent self-supporting, by the value obtained from the produce of their labour. The latter purpose has more especially been followed out in continental prisons, but neither there nor in Britain can its success be said to have been very great. In the latter country, indeed, the view taken of prison labour is not so much that of an expedient by which the debt incurred by the prisoner to society may be liquidated, but as a system of penal exertion to act as a warning in deterring others from the commission of crime. The first experiment in the last-mentioned direction was the institution of the tread-mill, which consists of a huge cylindrical wheel, turned by the treading of the prisoners. A strong objection to this mode of punishment was the fact that an equal degree of labour was thus apportioned to each prisoner, without any regard to the diversities in the amount of personal strength possessed by each. It has accordingly been generally abandoned in the penitentiaries, and superseded by the crank, which consists of a small wheel, resembling the paddle-wheel of a steamboat, and revolving in a box partly filled with gravel. The wheel is kept in motion by the turning of a handle on the outside by the prisoner, the labour performed by him consisting in the continuous shovelling up of the gravel, which is thrown up by the wheel in the same manner as water is thrown off from the paddles of a steamer. Such an occupation may suggest itself to the reader as bearing a considerable resemblance to the labours of Sisyphus in classic mythology. Many plausible arguments have been urged against this method of punishment, founded principally on the uselessness of the task performed, and the impolicy of employing a prisoner in merely afflictive labour. It nevertheless continues to be the system most generally adopted in British prisons, and is stated to have practically a most beneficial effect in increasing the odiousness of a prison, and inspiring a wholesome dread of committing any act by which so disagreeable a penalty may be incurred. By the act of 1865 hard labour is to consist of work at the tread-wheel, crank, capstan, stone-breaking, or such other like description of bodily labour as justices in session, with the approval of the secretary of state, may appoint.

PRISONERS OF WAR are persons captured from the enemy in time of war. In ancient times prisoners of war became the slaves of their captors, and even yet it is a recognized principle among nations that all the inhabitants of a vanquished town, state, or nation become the absolute property of the victors; though it is hardly necessary to say that the principle is now no longer acted upon by civilized nations. When a hostile army enters a country non-combatants are usually left unmolested, so far at least as their personal liberty is concerned. The combatants who have laid down their arms become prisoners of war, and their persons are at the entire disposal of the conquerors. The practice is to keep them in confinement till the termination of the war, or until a mutual exchange of prisoners between the warring states gives them their liberty. They are commonly treated in a somewhat similar manner to ordinary prisoners, only they are not generally subjected to penal labour. (See PAROLE.) In 1811 about 50,000 Frenchmen were prisoners of war in England, while about 10,000 English were in French prisons.

PRISREND, or PERSERIM, a town of European Turkey, in Albania, on the right bank of the Rieka, 4 or 5 miles from its confluence with the Drin. It is the residence of a pasha, and the seat of a Greek

metropolitan and a Catholic bishop. Among its buildings it numbers forty-two mosques, one Catholic and five Greek churches. It has considerable manufactures of fire-arms, which are much celebrated; and a large traffic with the adjacent country, and with many of the large towns in Albania, Roumelia, and Servia. Pop. about 26,000.

PRISTINA, or PIRISTINA, a town of Turkey in Europe, about 100 miles north-east of Scutari. It is the residence of a pasha, and the see of a Greek bishop; and contains a number of handsome mosques, bazaars, baths, and other buildings. Pop. 10,000.

PRITZWALK, a town in Prussia, in the government and 66 miles north-west of Berlin, on the left bank of the Temnitz. It is walled; has three gates, a Protestant church, hospital; manufactures of woollen and linen cloth, a tobacco-factory, and a brewery. Pop. (1880), 6041.

PRIVAS (Latin, *Privatium Castrum*), a town in France, capital of the department Ardêche, at the junction of three small streams, and inclosed by an amphitheatre of rugged and arid hills, 21 miles south-west of Valence. It has a prefecture, with a fine park adjoining; courthouse, hospital, and prison; a court of first resort, an agricultural society, and a communal college; manufactures of blankets and other woollen stuffs, silk thread and yarn, leather, and brandy; and a trade in silk, cattle, leather, coals, &c. It was once a place of great strength and importance, and a kind of rallying-point for Protestantism. Its inhabitants were butchered, its houses burned, and its fortifications razed by the Papists; the leader in this atrocity was Louis XIII. Pop. 5932.

PRIVATEER, a vessel of war owned and equipped by private individuals to seize or plunder the ships of an enemy. Such a vessel must be licensed by government and under a letter of marque, otherwise she is a pirate. The first check to the practice of private plundering upon sea so universal in earlier times, was by confining the right to those who received letters of marque or of reprisals. These were issued upon the petition of a subject who complained of injustice done him by some foreign prince or subject, and they empowered the party to obtain satisfaction by seizing the goods of any subject of the offending state. It does not seem to have been considered necessary to be provided with letters of reprisals till the fourteenth century, and no mention is made of them in treaties prior to that time. The practice of granting commissions to privateers did not become general before the end of the sixteenth century. The first instance in which their aid appears to have been considered important in carrying on war was in the contest between Spain and her revolted provinces of the Low Countries, which began in 1569. In 1570 the Prince of Orange, in the hope of replenishing his impoverished finances by seizing on the money sent from Spain to the Netherlands, issued commissions to many of his adherents authorizing them to cruise against the ships of Spain. A considerable fleet was equipped, and increasing daily in numbers they soon became terrible by their depredations, not only on the commerce of Spain and the Netherlands, but on that of their own and other countries. The French, however, were probably the first to send out in considerable numbers these scourges of the sea. Their code exhibits the most ancient regulations concerning privateers, and their maritime laws have always been the most severe against the commerce of neutrals. In 1555 the people of Dieppe fitted out nineteen ships and six brigantines, in consequence of having received a commission to attack several Dutch ships of great burden returning from Spain. Spain and England, shortly after the depredations committed under the commissions of the Prince of Orange, issued commissions to great numbers of privateers. The expeditions of Drake and Frobisher are said to have been of this nature. The Dutch war for independence, which began in 1569, did not end till 1648. In that long contest the use of privateers became familiar, and remained so for a long time in all wars between maritime countries. The evils suffered from them, and the complaints of neutrals, became so great that various expedients were resorted to for checking their excesses. In 1785, by a treaty concluded between the United States of America and Prussia, it was provided that neither of the contracting powers should grant or issue any commission to any private armed vessels empowering them to take or destroy trading vessels. It was not till 1856 that the European powers mutually agreed to abolish the practice of privateering.

PRIVET (*Ligustrum*), a genus of plants of the natural order Oleinæ in the Linnæan system Diandria Monogynia. The calyx is short, tubular, and four-toothed; the corolla funnel-shaped, four-partite; the stamens, two in number, are seated on the tube of the corolla, and the style is very short; the flowers are small, white, and disposed in terminal panicles; shrubs with opposite leaves; berries usually small and globular. The Common Privet (*L. vulgare*) is a native of Europe, common in hedges and woods; the leaves are elliptico-lanceolate, entire, and smooth; the flowers slightly odorous, white at first but soon changing to a reddish-brown; and the berries dark purple, approaching black. This species is much used in gardens for ornamental hedges and for shelter. The wood is hard, and used by turners and shoemakers for pegs. A rose-coloured pigment is obtained from the pulp of the berries, which are also used, with the addition of alum, to dye wool and silk of a durable green. The berries remain upon the shrubs till spring.

PRIVILEGE (Latin, *privilegium*=*privata lex*, a private law), a particular beneficial exemption from the general rules of law. This exemption may be either *real* or *personal:* real, when it attaches to any place; personal, when it attaches to persons, as ambassadors, members of Parliament, clergymen, lawyers, and others. Formerly religious houses and certain localities conferred the privilege of freedom from arrest upon those entering them, and more recently many places existed which privileged those within them from arrest in civil suits. These now no longer exist. At present, however, no arrest can be made in the royal presence, nor within the verge of the Palace of Westminster, nor at any place where the sovereign resides, or the judges are judicially sitting. Personal exemption from arrest is guaranteed to all suitors, counsel, or other persons attending any court of record upon business; or to an arbiter under a rule of *nisi prius*.

PRIVY-CHAMBER, GENTLEMEN OF THE. Officers of the royal household of England, instituted by Henry VII. Their duties are to attend the sovereign; but their appointment is now merely honorary, no services being required of them, nor salary or fee granted them. There are also four gentlemen ushers of the privy-chamber, whose office is to wait in the presence chamber, attend on the sovereign's person, and note affairs under the lord-chamberlain and vice-chamberlain.

PRIVY-COUNCIL (*consilium regis, privatum consilium*), a council of state held by the British sovereign and councillors, to concert matters for the public service, and for the honour and safety of the realm. Until the rise of the cabinet the most responsible and influential advisers of the crown in state affairs were the members of the privy-council.

the form of pits, with an iron grating at the top in the form of a trap-door, several of the prisoners committed suicide to escape from the horrors of their situation. The solitary system having thus, in a great measure, proved a failure in America, the invention of social legislators was again set on the rack to devise some equally effectual means of punishment without such objectionable adjuncts, and the second great experiment in prison discipline—the silent system—was accordingly instituted. The principal establishment where this system was carried out to its utmost extent was the penitentiary of Sing Sing in the state of New York. The prisoners were still, as at Auburn, confined to separate cells during the night, but in the daytime were conducted out to large rooms where they worked together, but without being allowed to exchange a single word, or so much as a single glance, with any of their companions. Throughout the whole period that they worked together in their common compartment, as well as during and after their return to their cells, this system of sepulchral silence was rigidly maintained. An transgression of these rules was followed by t immediate infliction of corporal punishment in shape of whipping, and this penalty was eq incurred by the prisoner speaking to one fellow-prisoners, or to a stranger visiting the To insure the efficacy and promptitude of ishment, the humblest officer in charge soners had necessarily to be intrusted wi of administering it, and no appeal w the prisoners against the acts of any an irresponsible authority must do instances, have been liable to be gr to so much more so from the impo , and at the truth of any charge brou me court of the prison in the case of a matters of made. It has also been arg Britain; but imposed under the silent sing out of the prove as injurious to the m and idiocy even it as the consequences r rivy-council may take finement under the so appeal. The council one of the most effectu nctions by 'the judicial method is to be fou cil,' constituted by 3 and the most rigid rest committee now consists the prison of Si seal, the chief justices, the application of s chief baron, and other great found impossib any other two privy-councillors communicatio ted by the sovereign; and it This circum powers for enforcing its decrees as covery of t ery, the Court of Queen's Bench, supposed a privy-councillor enjoyed certain —so im ect of personal security, but these restrict , and any offence against a privy- or th upon the same footing as offences are other individual.

a of privy-council is of great antiquity: s nt of England was originally conducted sovereign and privy-council, and its acts, orders or proclamations, were of the greatest Now, however, the portion of the privy- known as the cabinet (see BRITAIN—Administration of the Government) is the most important of the government, forming in fact the executive government of the kingdom. In Scotland the privy-council consisted of persons chosen by the king to advise with in matters of government and police; but by an act of Anne the Scotch privy-council was absorbed in the British privy-council, which is by that act declared to have no other or higher powers than were possessed by the English privy-council at the time of the Union.

Orders in council are orders issued by the sovereign, by and with the advice of the privy-council, either by virtue of the royal prerogative, and independently

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The number of privy-councillors is indefinite; they are nominated by the sovereign at pleasure, and no patent or grant is necessary, but they must be natural-born subjects. The list of privy-councillors now embraces, besides the members of the royal family and the members of the cabinet, the Archbishops of Canterbury and York, the Bishop of London, the great officers of state, the lord-chancellor and judges of the court of equity, the chief justices of the courts of common law, the ecclesiastical and admiralty judges, and the judge advocate, several of the puisne judges, the speaker of the House of Commons, the ambassadors, some of the ministers plenipotentiary and governors of colonies, the commander-in-chief, the master-general of the ordnance, the first lord of the admiralty; and sometimes other persons who fill or have filled responsible offices under the crown. It is only on very extraordinary occasions that all the members attend the council, and it is not now usual for any member to attend unless specially summoned. The attendance of at least six members is necessary to constitute a council. The council is summoned on a notice of forty-four hours, and is never held without the presence of a secretary of state; the junior councillor delivers his opinion first, and the sovereign when present last. Formerly it was dissolved by the death of the sovereign; but by 6 Anne, cap. vii., it is not dissolved till six months after the demise of the crown, unless sooner determined by the successor. Privy-councillors are by their oath bound to advise the crown without partiality, affection, or dread; to keep its counsel secret, to avoid corruption, and to assist in the execution of what is there resolved. The council has power to inquire into all offences against government, and commit the offenders to take their trial in some court of law. It cannot take cognizance in matters of property belonging to subjects in Great Britain; but in colonial and maritime causes arising out of the kingdom, and in cases of lunacy and idiocy even when involving property, the privy-council may take cognizance, being the court of appeal. The council is assisted in its appellative functions by 'the judicial committee of the privy-council,' constituted by 3 and 4 Will. IV. cap. xli. This committee now consists of the keeper of the great seal, the chief justices, the master of the rolls, the chief baron, and other great judicial officers, with any other two privy-councillors who may be nominated by the sovereign; and it possesses the same powers for enforcing its decrees as the Court of Chancery, the Court of Queen's Bench, &c. Formerly a privy-councillor enjoyed certain privileges in respect of personal security, but these are now abolished, and any offence against a privy-councillor stands upon the same footing as offences against any other individual.

The court of privy-council is of great antiquity: the government of England was originally conducted by the sovereign and privy-council, and its acts, whether orders or proclamations, were of the greatest authority. Now, however, the portion of the privy-council known as the cabinet (see BRITAIN—Administration of the Government) is the most important branch of the government, forming in fact the executive government of the kingdom. In Scotland the privy-council consisted of persons chosen by the king to advise with in matters of government and police; but by an act of Anne the Scotch privy-council was absorbed in the British privy-council, which is by that act declared to have no other or higher powers than were possessed by the English privy-council at the time of the Union.

Orders in council are orders issued by the sovereign, by and with the advice of the privy-council, either by virtue of the royal prerogative, and independently of any act of Parliament, or by virtue of such act, authorizing the sovereign in council to modify or dispense with certain statutory provisions which it may be deemed expedient in particular conjunctures to alter or suspend. When a permission is to be given to a particular individual, it is usual to grant it by license; but orders in council are of a more general nature, and contain dispensations or prohibitions extending to a whole branch of commerce.

PRIVY-COUNCIL, COMMITTEE OF, ON EDUCATION, a committee appointed in Britain in 1839 for administering the grants which it had been the practice of the government to make for some time previously, with a view to meet the educational wants of the country. In 1833 the educational destitution of the nation became so apparent, and the insufficiency of the voluntary agencies that had hitherto existed to apply any effectual remedy to the growing evil so clearly demonstrated, that the state was impelled by the necessities of the case to take some share in the education of the people. To this end small parliamentary grants were made, and were distributed by the treasury under regulations issued in 1833, the chief of which was that no application should be entertained by the treasury unless a sum were raised by private contribution equal, at least, to one-half of the total estimated expenditure. In 1839 it was resolved to increase these grants, intrusting their administration to a committee of the privy-council appointed for that purpose. It was only contemplated in the first instance to aid the two great societies existing at that time for the promotion of education, namely, the British and Foreign School Society, founded under the patronage of George III.; and the National Society, set on foot at a later date by the Church of England; but they almost immediately departed from this intention, resolving to assist other schools where special circumstances hindered their affiliation to the societies; and it ultimately came to this that all schools were aided in which the Bible was daily read from the Authorized Version. The largely increased number of schools which this prospect of state aid gave rise to, and the consequent need of particular care in the administration of the government grants, to see that these were properly applied, necessitated the appointment of inspectors of schools. These were appointed by the queen, subject, however, to the veto of the Church of England, and of the education committees of Dissenting churches, with regard to those appointed for their respective schools; but no school was to receive aid which did not submit to inspection. Grants given for the erection of schools were regulated by the number of children to be educated, and the amount of private contributions. The appointment of pupil-teachers, paid by government, as well to aid the master as to be themselves instructed, in terms of a programme drawn up by the committee of council, was the first step taken towards granting aid for the maintenance in addition to the erection of schools. It was also resolved about the same time (1846) to grant a small allowance to deserving teachers. Pupil-teachers were to serve an apprenticeship of five years, and to be paid £10 for the first year, to be increased each following year by £2, 10s. over the preceding one. To enable pupil-teachers to complete the training necessary to qualify them to be teachers after finishing their apprenticeship, the Queen's scholarship of the value of £20 was instituted, which was to be given on their entering a normal school, and at the conclusion of their training there the normal school was to receive a grant of money, which was to vary according to the length of time the student had attended the school. A further grant was to be allowed annually to duly instructed

teachers, subject to certain conditions, one of which was the possession of a certificate from the normal school, and the amount of the grant was made partially dependent upon the grade of the certificate, partially also on the inspector's report upon the school. These regulations applied also to Scotland.

In 1863 a revised code was issued in pursuance of the suggestions of the royal commission appointed to inquire into the state of primary education. In terms of this code all payments were thenceforth to be made in the form of capitation grants, a system partially adopted some years before, the sum payable for each child to be 12*s.*, subject to a deduction of 2*s.* 8*d.* for every child who failed in reading; and similar deductions for those who failed in writing and arithmetic. By this code also all payments came through the managers. This revised code did not apply to Scotland.

Since the passing of the Education Acts of 1870 and 1872, for England and Scotland respectively, primary public education in these two countries is now entirely regulated by these acts (see BRITAIN—Education), the supreme administrative body being still, however, the committee of privy-council on education.

PRIVY-PURSE, KEEPER OF THE, an officer of the royal household of Great Britain, whose function it is to take charge of the payment of the private expenses, including charities, of the sovereign. He has no control over any official or household expenses, and is independent of the great officers of the household.

PRIVY-SEAL (*privatum sigillum*), a seal appended by the British sovereign to such grants or things as are afterwards to pass the great seal; and sometimes used in things of less consequence, which do not require to pass the great seal, as to discharge a recognizance, debt, &c.; but no writ which relates to the common law can pass the privy-seal. Since the time of Henry VIII. the privy-seal has been the warrant of the legality of grants from the crown, and the authority for the lord-chancellor to affix the great seal. Such grants are termed letters-patent. The officer who has the custody of the privy-seal was anciently called clerk of the privy-seal, afterwards guardian *del* privy-seal, and now he is called lord privy-seal, and is the fifth great officer of state, having also generally a seat in the cabinet. The lord privy-seal must not put the seal to any grant without good warrant; nor with warrant if it be against the law or inconvenient without first acquainting the sovereign therewith. By the Act 11 and 12 Vict. cap. lxxxii. (1848) it was provided that warrants under the royal sign-manual, prepared by the attorney-general and solicitor-general, setting forth the tenor and effect of the letters-patent to be granted, addressed to the lord-chancellor, and counter-signed by one of the principal secretaries of state, should be a sufficient authority for the privy-seal being affixed; and that the sign-manual so signed, counter-signed, and sealed, should be sufficient warrant to the lord-chancellor to pass letters-patent under the great seal. In Scotland the privy-seal is used in authenticating royal grants of assignable or personal rights.

PRIZE. By the term prize is generally understood anything captured in virtue of the rights of war (*jure belli*). Property captured on land is usually called *booty*, and is generally disposed of at once by the commanding general, or reserved for the disposal of his sovereign, who is accustomed to bestow and distribute it according to his discretion. In Britain by 3 and 4 Vict. cap. lxv. the jurisdiction in matters of booty of war is vested in the judge of the prize court (who is also judge of the admiralty court) on a reference by the sovereign; otherwise it is regulated by 2 and 3 Will. IV. cap. liii., which enacts that all captures shall be disposed of as the crown shall direct. Deserters entitled to prize-money do not receive any, and a certified list of the persons entitled to share in captures must be transmitted to Chelsea Hospital by the commanding officer. In some cases the prize money is paid after the soldier's decease without probate or administration. In regard to maritime captures a very different course has been pursued by all nations in modern times from that which obtains in cases of captures on land. The right of belligerents to capture the property of their enemies on the sea is admitted, as well as the right to prevent any frauds or violations of the law of nations on the part of neutrals. But these rights are limited, and must be so exercised as not to intrench upon the independence or rights of other nations. It is accordingly settled as a principle of the law of nations that every belligerent has a right to establish tribunals of prize, to examine into all maritime captures, and to decide judicially upon their validity; and likewise that the courts of prize of the captors have exclusive jurisdiction over all matters relating to captures made under the authority of their sovereign, and the courts of other nations have no jurisdiction or authority to inquire into, or to adjudicate upon them. The sentence of a court of competent jurisdiction once pronounced is conclusive and binding on all nations. Questions of naval prize-money in England are adjudicated by the courts of admiralty. The 27 and 28 Vict. cap. xxv. (1864), enacts permanently with amendments, such provisions concerning naval prize as had previously been usually passed at the beginning of a war. Every ship taken as prize, and without breaking of bulk, must in terms of this act be delivered up to the marshal of the court, and the captors must bring the ship's papers into the registry of the court; these provisions do not apply, however, to ships of war taken as prize. If the court decide that the capture is a legal one, the prize is then sold, and the proceeds are divided amongst the captors, both officers and men, in proportions varying according to the rank of each. If the prize be a ship of war the state grants a certain allowance per gun, which allowance is distributed in the same manner.

PRIZE COURT, an English tribunal existing only by special commission under the great seal during war, and as long as the litigations connected with it continue. This court, besides adjudicating upon questions relating to captures, prize, and booty, also adjudicates upon questions of international law. There is an appeal from this court to the queen in council. The judge in the court of admiralty presides in the prize court.

PROA, a peculiar kind of sailing-boat used by the natives and also the pirates of the Eastern Archipelago. It is strangely shaped, having one side quite flat, on a line with the stem and stern, while the other side is curved in the usual way. In order to keep it from upsetting, in consequence of this peculiarity in its formation, a frame carrying a weight is placed to windward, and this balances the boat when under sail. It carries a kind of lug-sail, and is equally sharp at stem and stern, so as to sail either way without turning. The usual dimensions of the proa are about 30 feet long by 3 feet wide.

PROBABILISTS, those philosophers who maintain that certainty is impossible, and that we must be satisfied with what is probable. This was the doctrine of the New Academy, particularly of Arcesilaus and Carneades. The last-mentioned philosopher distinguished three principal degrees of probability, according as a representation might be probable when considered by itself alone; probable and unim-

peached when compared with others; or thirdly, probable unimpeached and in all respects confirmed. In morals probabilists are those who teach that in our actions we must follow what seems to us most probably right, because in questions of morality demonstrative certainty is not to be attained. Among the Jesuits there were some who taught that a man may follow what is probably right, or what has been decided to be so by teachers of authority, although it may not be the most probably right, or may not seem probable to himself. It is this view that Pascal in his famous Provincial Letters holds up to ridicule. See JESUITS.

PROBABILITY, in algebra, the mathematical investigation of chances. If an event may happen in a ways and fail in b ways, and all these ways are equally likely to occur, the probability of its happening is $\frac{a}{a+b}$, and the probability of its failing is $\frac{b}{a+b}$. This is the definition of probability given in mathematical treatises. It is evident that as 'certainty' may be represented by unity, if the probability of an event's happening is p, the probability of its failing is $1-p$. When the probability of the happening of an event is to the probability of its failing as a to b, the fact is expressed in popular language thus—the 'odds' are a to b for the event, or b to a against the event. If there are three events such that one must happen, and only one can happen, and suppose the first event can happen in a ways, the second in b ways, and the third in c ways, and that all these ways are equally likely to occur, then it is evident that the probability of the happening of the first event is $\frac{a}{a+b+c}$, and of its failing $\frac{b+c}{a+b+c}$. Example: Suppose that 3 white balls, 4 black balls, and 5 red balls are thrown promiscuously into a bag, and a person draws out one of them; the probability that this will be white is $\frac{3}{12}$ or $\frac{1}{4}$, the probability that it will be black is $\frac{4}{12}$ or $\frac{1}{3}$, the probability that it will be red is $\frac{5}{12}$. But suppose two balls to be drawn out. The number of pairs that can be formed out of 12 things (see PERMUTATIONS AND COMBINATIONS) is 66; the number of pairs that can be formed out of 3 white balls is 3, and therefore the probability of drawing two white balls is $\frac{3}{66}$ or $\frac{1}{22}$. Similarly the probability of drawing two black balls is $\frac{6}{66}$ or $\frac{1}{11}$; two red balls, $\frac{10}{66}$ or $\frac{5}{33}$; a white and a black, $\frac{12}{66}$ or $\frac{2}{11}$; a black and a red, $\frac{20}{66}$ or $\frac{10}{33}$; a red and a white, $\frac{15}{66}$ or $\frac{5}{22}$. The sum of these six probabilities is unity. The probability of two independent or of two dependent events happening together, sometimes called the chances of compound events, is treated of in works on this subject. We shall mention a few of the more important problems. 1. Pascal's problem was: A and B play a set of games, in which A's chance of winning a single game is p, and B's chance is q; required the probability of A's winning m games out of $m+n$. 2. A bag contains 100 tickets, which are marked with the numbers 0, 1, 2, &c., 99 respectively; a ticket is drawn and replaced; required the probability that after five drawings the sum of the numbers drawn is 300. 3. There are two urns, one containing 7 white and 3 black balls, the other 5 white and 1 black ball; a white ball has been drawn; what is the probability that it has come from the first urn? 4. A bag contains 3 balls, and it is known that each ball is either black or white; a white ball has been drawn and replaced; what is the probability that another drawing will give a white ball? 5. The probability that a certain person speaks the truth is p, and the probability that another person speaks the truth is q, these two persons agree in making a certain statement; what is the probability of its truth? 6. Suppose that certain arguments are logically sound, and that the probabilities of the truth of their respective premises are known; required the probability of the truth of the conclusion. The theory of probabilities is very extensive. The simpler problems are worked out in Todhunter's Algebra, but further reference must be made to Boole's Laws of Thought and De Morgan's Formal Logic, and to various special treatises on the subject.

PROBATE, COURT OF, an English tribunal established by act of Parliament in 1857, to which all the powers that had been previously exercised by the ecclesiastical courts in the granting of probates of wills and letters of administration were transferred. This court was merged in the Supreme Court by the Judicature Act of 1874, by which its jurisdiction was assigned to a Probate, Divorce and Admiralty Division. The functions of this branch are confined entirely to deciding on the authenticity of wills and upon the proper persons to whom administration is to be committed when no will exists. If a party dies leaving a will it must be produced and verified at the registry in London or the district registries of the court in various parts throughout the kingdom, so that all concerned may be convinced of its authenticity. If its authenticity, after the examination of witnesses, is demonstrated the will is then registered, and the original deposited in the court. The act of court by which the will is proved is termed probate of will. On the other hand, if the party dies intestate application must be made to the court to appoint one of the next of kin as administrator of the personal estate of the deceased; this is done by the court by granting what is termed a letter of administration. In cases where a person dies in one of the districts, leaving personal property under £200, the judge of the county court of the district has jurisdiction should any contention arise, but his decision may be appealed from to this division of the Supreme Court. The practice of the court is thrown open to the whole legal profession, and its proceedings are otherwise assimilated to the courts of common law.

PROBOSCIDEA, the term applied in recent systems of Mammalian classification to denote an order of the class including the Elephants alone, which are distinguished, as implied by this name, by the possession of the characteristic proboscis or trunk. This order is occasionally grouped as a subdivision of the larger order of Ungulata or Hoofed Quadrupeds, or may be treated as an entirely distinct and separate group. But two existing species—the Indian and African—of Elephants are known; the Proboscidea, however, include the fossil and extinct Mammoths, Mastodons, and Deinotherium. See also ELEPHANT, MAMMALIA, &c.

PROBOSCIS, the term applied to the longer or shorter flexible muscular organ formed by the elongated nose of several mammals. Although seen in a modified degree in the Tapirs, &c., the term is more generally restricted, and applied to indicate the flexible 'trunk' of the Elephants, this structure having been in all probability also possessed by the extinct Mammoths (which see), Mastodons (which see), and Deinotherium. One of the Quadrumana or Monkeys, the Proboscis Monkey (which see), or Kahau, also possesses an elongated nose, this form being found in Borneo. The proboscis of the elephant exhibits a highly-complicated muscular structure, and is formed essentially of a modification of the muscles of the nose and lips. Two *elevator* muscles arise, one on each side, from above the nasals; a second pair of *depressors* take origin from the premaxillæ, and a third pair of *lateral and longitudinal* muscles arise on each side from

the frontal and maxillary bones. In addition to these representative muscles, homologous with those of other forms, the proboscis possesses a large number of intrinsic and special muscular structures, the fibres of these latter extending from the nasal passages to the inner surface of the skin, and tending by their action to keep the nostrils patent and open. The conical tube, 4 or 5 feet in length, thus formed, is elongated, tapering, and truncated, and funnel-shaped at its free extremity; a concave surface containing the openings of the nostrils. The free extremity is provided with a movable finger-like appendage, by means of which the smallest objects may be readily picked up. Internally the proboscis exhibits the structure of a double tube corresponding to the nostrils. These tubes are continued upwards to the true or bony nostrils of the skull; but before their union with the bony structures the tubes are curved, and the nostrils are guarded at this point by an elastic valve of cartilaginous material. The use of this valvular structure is to prevent fluids and other substances from entering the true nasal passages; the valve being ordinarily kept closed by muscular action or its own elasticity, but being readily opened at the will of the animal. The numerous muscles of which the proboscis is chiefly composed enable the structure to be manipulated and used in every conceivable manner. It thus performs the functions of an arm and hand; it is an organ of touch and of smell, and may be used as a powerful weapon. The proboscis is convex or rounded on its upper surface, and fluted along its breadth, the lower side being more or less flattened.

PROBOSCIS MONKEY (*Presbytes larvatus* or *nasalis*), a genus of Quadrumana or Monkeys, included in the Catarhine section of that order, and closely related to the genus Semnopithecus of Asia. The Proboscis Monkey or Kahau is a native of Borneo, and is distinguished by the elongated nose, giving a peculiarly ludicrous appearance to these forms; by the shortened thumbs, and elongated tail. The nose is capable of being dilated, and the nasal apertures open beneath the somewhat curved point; the ears are of small size; the face and palms are of a leaden yellow colour; the hair on the sides of the head and neck is longest; the upper parts of the back and head are coloured of a chestnut brown, the sides of the face and shoulders being yellow. The general body-colour is a sandy red; the tail is dark above, but of a light yellow colour beneath. The males possess prominent canine teeth, and the name 'Kahau' has been applied to these forms from its resemblance to their cry. These monkeys are arboreal in habits, and appear to frequent the neighbourhood of streams and rivers, congregating in troops. (See Pl. VI.–VII. fig. 6.)

PROBUS, Marcus Aurelius, one of the ablest of the Roman emperors, was born at Sirmium in Pannonia in the year 232. His father Maximus, after having served with distinction as a centurion, was promoted to the rank of tribune, and died leaving but a very small fortune to his children. At a very early age Marcus attracted the notice of the Emperor Valerian, who at once conferred upon him the office of tribune, an act which was fully justified by the skill and bravery he displayed in the wars in which he was thereafter engaged. He was soon placed at the head of a legion, and the brilliancy of his conduct in the African, Persian, Arabian, and Germanic campaigns brought him into still more prominent notice. He was nominated governor of all the Roman provinces in Asia by the Emperor Tacitus, and was in command of the Syrian legions when, in 276, Florianus, who succeeded his brother Tacitus, was murdered. Such was the favour in which Probus was held by senate and people, as well as by his soldiers, that he was immediately proclaimed emperor by universal consent. His chief struggle during his reign was to guard the frontiers of the empire against the barbarians. He drove back the Franks, Burgundians, Alemanni, and Vandals, who had invaded Gaul; and once more, in 277 and 278, secured the frontier wall which (built between the Danube and the Rhine) separated the Decuman fields of the Romans from the free Germans. He also freed the lands south of the Danube, Egypt (which the African Blemmyes had invaded), and the East from devastating barbarian hordes; lastly he expelled the Goths and Alans from Asia Minor, drove back the pillaging Isaurians, concluded an advantageous peace with the Persians, and gained the superiority over the rebel Saturninus and the rival emperors Proculus and Bonosus. With regard to the internal condition of the empire, he gave new dignity to the senate, and with the view of giving a population to the desolate frontier provinces, gave settlements to large masses of barbarians, as well as to 100,000 Bastarnæ in Thrace—a measure, however, which, though well meant, was clearly no less dangerous than was the admission of 16,000 barbarians into the legions. He paid particular attention to agriculture, abolished an ancient law which, aiming only at the advantage of Italy, prohibited the culture of the olive and vine in the Transalpine provinces, and thus introduced the culture of the olive into Provence, and of the vine into Gaul, Rhine, and Pannonia. He kept his soldiers actively employed in public works, as the making of roads and draining of marshes. Irritated, however, at being charged with occupations which they deemed degrading, they took advantage of the opportunity afforded by his presence among them while draining the swamps about Sirmium in 282 to rise in insurrection and assassinate him. A skilful military leader, and a statesman with views as elevated as they were just, Probus united to great talents some of the fairest virtues. He was one of the few Roman emperors who did honour to humanity.

PROBUS, Marcus Valerius, a well-known grammarian, born at Berytus in Syria, lived in the first century of our era under Nero until the time of Domitian, and wrote several works, including Scholia on Terence and Virgil, which have been lost. A work entitled Institutionum Grammaticarum Libri Duo, and a treatise on Roman Stenography, bear his name, but belong to a later period.

PROCACCINI, the name of a family of artists of the sixteenth century from Bologna.—1. Ercole Procaccini, born in 1520, was the head of a school of painting which he founded at Milan on similar principles to that of the Caracci at Bologna, but with less success. His works, existing at Bologna and Parma, are not remarkable for talent, but exhibit an industry and care which accorded with the mannerism of his contemporaries, and made him in great request as a teacher.—2. Camillo Procaccini, son and scholar of the former, born in 1546, was the most distinguished artist of this school. He profited much by studying the school of the Caracci, and selected especially Corregio and Parmegiano for his models. The imitation of them in some of his paintings is equally obvious and successful. He is very unequal, however, and not unfrequently betrays a kind of flightiness and forgetfulness of nature. His best works are in the churches and gallery of Milan. Among others may be mentioned a Madonna and Child in the church of Santa Maria del Carmine, and a Homage of the Kings in the Brera. He died at Milan in 1626.—3. Giulio Cesare Procaccini, brother of the former, born in 1548, likewise strove to equal the school of the Caracci, and took for his model Corregio, whom he imitated with so much success

that several of his pictures, though far from reaching the grace and harmony of that great master, have often been ascribed to him. This has been the case especially with cabinet pictures of the Fall. His works are to be met with in many galleries. The exact year of his death is not known, but is supposed to have been, like that of his brother, in 1626.

PROCEDURE, CIVIL, is the method of proceeding in a civil suit throughout its various stages. In England, when redress is sought by law for a civil injury, the injured party brings an *action* against the party whom he alleges has done the injury. This action he may bring either *on the case*, as a general action, where the law has provided no specific remedy for the violence done; or *upon a statute*, under which he seeks redress either by the express words of the statute, or by implication. Action *qui tam*, or *popular* action, is such as is given by acts of Parliament, which create a forfeiture and impose a penalty for the neglect of some duty. The person who raises an action is termed the *plaintiff*, and he against whom the action is brought the *defendant*. It is usual before the suit is commenced for the plaintiff's attorney to acquaint the defendant by letter with the demand of his client, and state that unless complied with legal proceedings will be instituted. Should this not have the desired effect, the action is begun as a rule by issuing against the defendant a *writ of summons*, which is a judicial writ proceeding from the court which takes cognizance of the action, commanding him to enter *an appearance* in the court, failing which an appearance will be entered for him by the plaintiff. (See NON-APPEARANCE.) When an appearance has been entered both parties to the suit are now said to be *in court*, and judgment may be proceeded with. The next stage is the *pleadings* or the statements in legal form of the cause of action or ground of defence brought forward by the respective sides. They begin by the plaintiff delivering an instrument to the defendant called a *declaration*, containing the subject-matter of the complaint or ground of action, and requiring him to plead or put in his answer, which he must do within a certain number of days. Among other pleas the defendant may plead the statute of limitations. Personal actions for trespass or debt on simple contract must be commenced within six years after the cause of action, and actions of assault, menace, or imprisonment within four years after the commission of the injury. Actions on bills of exchange, attorneys' fees, and a demand for rent on a *parole* lease, as well as in matters connected with mercantile accounts and trade, must be within six years. An action for the recovery of land must be brought within twenty years from the time at which it might first have been raised. No arrears of rent or of interest in respect of any sum of money charged upon or payable out of land or rent, or in respect of any legacy, is recoverable after the expiration of six years from the due date. It is provided, with regard to pleadings, by the Common Law Procedure Act of 1852 that where the parties are agreed as to the question of fact to be decided between them, they may, by consent and order of a judge, proceed to trial without formal pleading. The next stage of procedure after the pleadings is the *issue*, which may be either on matter of law, when it is called a *demurrer*—the statement of facts being admitted, but the law arising upon those facts as stated by the opposite party being denied—or on matter of fact, where the fact only is disputed. A demurrer is determined by the judges after hearing argument on both sides, but an issue of fact has to be investigated before a jury, and this is denominated *trial by jury*. (See JURY and JURY TRIALS.) After the judge has summed up to the jury the *verdict* follows and then the *judgment* of the court. There are certain cases, however, in which judgment may be suspended and a new trial granted where there has been any defect in the trial; but if the judgment is not suspended, appealed against, or reversed, then follows the final stage of the proceedings, the *execution* or enforcement of the sentence, which brings the suit to a conclusion.

PROCESSION, RELIGIOUS, a solemn march of the clergy and people, attended with religious ceremonies, prayers, singing, &c., around the altars and churches, or in the streets, for the purpose of returning thanks for some divine blessing, or averting some calamity, &c. The practice of holding such processions is usually said to have been introduced into the Christian church in the reign of Constantine. The most celebrated processions which now take place in the Roman Catholic Church are those of the eucharist on Corpus Christi day, and during the week in which it occurs. They owe their origin to John XXII. The processions in honour of St. Mark and those on Candlemas and Palm Sunday are said to have been instituted by Gregory the Great. Religious processions are not held in Protestant countries. Instances of celebrations of this nature are to be found among the Jews in the Old Testament, and as a part of the symbolical worship of nature they were in use among the ancient heathens; thus they formed solemn processions about the fields, which had been sowed, and sprinkled them with holy water to increase their fertility, and to defend them from injuries. The festivals in honour of Bacchus, Ceres, Diana, and other divinities, among the Greeks and Romans, were solemnized with processions, in which the images of the gods were borne about; and similar rites are still found among most heathens. Among the Buddhists these ceremonials are especially imposing. The procession which accompanies the Emperor of China when he goes to offer sacrifices to an idol in some great pagoda is one of the most gorgeous description.

PROCESSIONAL, a service-book of the Roman Catholic Church, containing the prayers to be said and the hymns to be sung at different stages in religious processions. Some of the processionals of ancient date are very rare, and highly valued by bookfanciers. Among the rarest is that used by the see of York, and printed in a revised form in 1530.

PROCESSION OF THE HOLY GHOST. See GHOST (HOLY).

PROCIDA (anciently, Prochyta), an island in Italy, Naples, lying nearly midway between the island of Ischia and the coast of the province of Naples. It is about 3 miles long, north-east to south-west, and little more than 1 mile broad. The principal place of the island is Procida, or Castello di Procida, which stands on the south-east coast, 12 miles W.S.W. of Naples. It is fortified, has a good harbour, and a considerable trade. There is a palace on the island which was occasionally used as a residence by the former kings of Naples. On festivals the women assume the Greek costume, consisting of a red upper garment with gold embroidery. It is from this island that Giovanni da Procida, the reputed originator of the massacre known by the name of the Sicilian Vespers, takes his name. Pop. of the island, about 12,000.

PROCIDA, GIOVANNI DA. See SICILIAN VESPERS.

PROCLAMATION, ROYAL, a public notice made by the sovereign of a country to his subjects, concerning any matter which he thinks fit to give notice about. It may consist either of an authoritative announcement of some great event affecting the state, of the declaration of the exercise of some royal prerogative (as in the summoning, prorogation, and

dissolution of Parliament), or of the intention of the crown to enforce some law that has remained dormant. A royal proclamation must be issued under the Great Seal. A statute of Henry VIII. making royal proclamations of equal validity with acts of Parliament was repealed by 1 Edward VI. cap. xii. Act 1 Will. and Mary, cap. ii., denies the crown the power of suspending or dispensing with any existing law of proclamation. Hence it follows that royal proclamations are only binding when they do not contradict existing laws or tend to establish new ones.

PROCLUS, a philosopher of the Neo-Platonic school, born at Byzantium in 412; died at Athens in 485. He is usually called the Lycian, because his parents came from Xanthus in Lycia. He received his first education at Alexandria from the famous Peripatetic Olympiodorus the elder, and completed it so thoroughly at Athens under Syrianus, who ultimately appointed him his successor, and under the guidance of Asclepigenia, who had acquired from her father Plutarchos the doctrines of the orphic and Chaldaic mysteries and the united theurgic sciences, that he was familiar with all branches of philosophy and theology. As a teacher at Athens he was very successful. His system aimed at the widest comprehensiveness. Hence he not only endeavoured to unite into a single whole all the philosophical schemes that had been handed down from former ages (one of his works, now lost, was devoted to showing the agreement subsisting between Orpheus, Plato, and Pythagoras); but made it a maxim that a philosopher should embrace also all religions by becoming infused with their spirit. Following out this maxim he composed hymns in honour of the pagan deities of Greece, defended and interpreted the popular myths regarding them, and even observed the rites connected with their worship, and considered himself as honoured by their special protection. It was probably in consequence of this adherence to the ancient religion of Greece in opposition to the decrees of the emperors who were now Christian, that Proclus was compelled to withdraw himself for a time from Athens. He travelled for a year in Asia, and took advantage of his sojourn there to study the various religions of its inhabitants. All of them he held in reverence, although he still continued to be more peculiarly attached to the religion of ancient Greece. On his return to Athens, where he remained till his death, he re-opened his school, but he now performed his religious services in secret, and reserved certain of his doctrines for the most intimate and trusted of his disciples. By his pure morals and religious views he gave his scholars the idea that he had intimate intercourse with gods and demons, and could work miracles. In his writings he professes to return to Plato, and to bring down Neo-Platonism from the misty heights to which it was raised by Plotinus. He also claims to resemble Plato in supporting his doctrines by an unbroken chain of reasoning, a method that had been altogether neglected by the previous Neo-Platonists. But these pretensions are not borne out by the works of his that have come down to us. The logical connection of his doctrines is only apparent, and as for the doctrines themselves they are equally unintelligible with those of his predecessors. A life or rather eulogy of Proclus was written by Marinus, one of his scholars, and his successor in the school at Athens. His extant works include a Sketch of Astronomy, in which he gave a short view of the systems of Hipparchus, Aristarchus, and Ptolemy; The Theology of Plato, Principles of Theology, Principles of Philosophy, a Commentary on the Works and Days of Hesiod, Life of Homer, &c. The best edition of his works is by Victor Cousin (six vols. Paris, 1820–27). Several of his works were translated into English by Thomas Taylor, 'the Platonist.'

PROCONSUL AND PROPRÆTOR. The administration of the Roman provinces was originally intrusted to prætors, but at a later period to proprætors, that is, prætors whose term of office had expired, and still later also to proconsuls, or consuls whose term of office had expired. The first consul who had his period of office prolonged, and received the title of proconsul, was Q. Publilius Philo in B.C. 327. This was done in order that he might have the opportunity of concluding a campaign that he had successfully begun in Lower Italy. After the Roman Empire had been extended over many countries it was provided by a law of C. Sempronius Gracchus that, at the consular and prætorial *comitia*, the senate should distribute the provinces into two consular and six prætorial provinces, for which the consuls and prætors should cast lots or divide them among themselves by agreement, a few days after their entrance upon office, after the expiration of the term of which they became the governors of the provinces allotted to them. Such at least was the arrangement till 55 B.C., but in that year it was provided by a decree of the senate that no consul or prætor should enter on the government of a province till five years had elapsed from the close of his consulship or prætorship. As the Roman rule was extended the number of prætorial provinces increased, for since there were never more than two consuls there could not be more than two proconsuls, unless the term of office of the latter were prolonged over more than one year, or (which was still more rarely the case) some person were appointed proconsul who had not previously held the office of consul. The duties of these provincial magistrates were the administration of justice, the supervision of other affairs of the province, and the command of the troops which were stationed in it. They were assisted in their duties by quæstors and legates. Within thirty days after his return to Rome the provincial governor was bound to make a report of the acts of his government and of the state of the province. The Lex Julia in 61 B.C. further required that a copy of his report (*rationes*) should be deposited in each of the two chief cities of his province. If he had permitted any acts of injustice or oppression he could be impeached therefor; as for extortion (*res repetundæ*), peculation or embezzlement of the public money (*peculatus*), or for abuses in regard to the army (*crimen majestatis*). Notwithstanding these precautions the provinces were subjected to various oppressions and exactions. From the time of Augustus the government of some of the provinces, all those that required the maintenance of an army, was taken out of the hands of the proconsuls and proprætors, and intrusted to legates who governed under the immediate direction of the emperor. See PROVINCE.

PROCOPIUS, ANDREW, the *Shaven* or the *Great*, a celebrated Hussite chief of the fifteenth century. He succeeded Ziska in 1424 as commander of the Taborites, and became the dread of the troops of the Emperor Sigismund. He made himself master of a large part of Bohemia, and ravaged Moravia, Austria, and Silesia. In 1433 he appeared with a large following at the Council of Basel, and demanded, in the name of the Hussites, the reform of the manners of the clergy, liberty for the ministers of religion, and the right of the laity to have the sacrament of the Lord's supper administered to them as well as the clergy. As the section of the Hussites led by Procopius were not satisfied with the concessions made by the council war was resumed, but Procopius was killed soon after in a battle fought at Böhmisch-

brod (1434). In the same battle perished another Procopius, the *Little*, who was the head of another section of the Hussites called the Orphans, and was united with the Great Procopius in all his enterprises after 1427.

PROCOPIUS OF CÆSAREA, a Greek historian, a native of Cæsarea, in Palestine, where he is supposed to have been born about 500 A.D. Having come to Constantinople to practise as an advocate he attracted the notice of Belisarius, who appointed him his secretary, in which capacity he attended him in his expeditions, of which he wrote the history. After he returned to Constantinople, a little before 542, he was appointed by the Emperor Justinian a senator and afterwards (562) prefect of the city. He is supposed to have died at Constantinople about 565 A.D. His works are a History of his Own Times, in eight books, the first two relating to the Persian war, the two following to the war with the Vandals, and the remaining four to the Gothic war; and a History of the Edifices built or repaired by Justinian. A kind of scandalous chronicle of the court of Justinian, including a most degrading account of the personal history of the emperor, the Empress Theodora, and others, and entitled Anecdota, has been attributed to him by some writers. The best edition of his works is that of Dindorf (Bonn, three vols. 1833–38).

PROCRIS, daughter of Erechtheus, and wife of Cephalus. See CEPHALUS.

PROCRUSTES ('the Stretcher'), a celebrated robber of ancient Greek legend, whose bed is still proverbially spoken of. The monster placed his guests in the bed, and then if they were too short, under pretence of fitting the bed to the occupant, he stretched the latter till he died. If his guest was tall Procrustes reduced him to the proper dimensions by cutting and clipping. Theseus finally served him as he had served others.

PROCTER, BRYAN WALLER, an English poet and prose writer, born about 1789; died in London, October 4, 1874. He was educated at Harrow, where he was the school-fellow of Byron and Peel. After finishing his school education he became an articled clerk to a solicitor at Calne, in Wiltshire. Subsequently he studied law in London, and in 1831 was called to the bar as a member of Gray's Inn. For some time he held the office of a commissioner of lunacy, but resigned it in 1860. His first appearance in literature was in 1819, when he published a volume, entitled Dramatic Scenes and other Poems. The author appeared before the public in this work under the pseudonym of Barry Cornwall, which he afterwards retained. This first essay was well received by the critics, and Charles Lamb said with regard to the dramatic scenes, that had he found them in an anonymous manuscript among the Garrick papers in the British Museum, he would have had no hesitation in giving them a place in his Specimens of English Dramatic Poets who lived about the time of Shakspere. This was followed by A Sicilian Story and Marcian Colonna. In 1821 he produced a tragedy, Mirandola, which was performed with great success at Covent Garden. The poetical works of Procter, which were given to the world after Mirandola, were the Flood in Thessaly, and English Songs and other Small Poems. His prose works include Effigies Poeticæ, or the Portraits of the British Poets, a Life of Edmund Kean, a volume of Essays and Tales, and a Memoir of Charles Lamb. The last-mentioned work, which was published in 1866, and is the last that Procter wrote, is perhaps the most interesting of all his prose writings. It is the work of one who thoroughly understood Lamb, and who was one of his most intimate friends during the last seventeen or eighteen years of his life. As a poet Procter does not take a very high rank in English literature; but he was nevertheless a true poet, distinguished as such for an intellectual refinement and grace, which excited the admiration of his brother poets, if they did not suit the popular taste.

PROCTOR (from the Latin *procurator*), a person who in the ecclesiastical and admiralty courts in England performs the duties of an attorney or solicitor. Since the abolition of the greater part of the jurisdiction of the ecclesiastical courts proctors have been admitted to practise in the Courts of Equity and Common Law, as well as in the Probate and Divorce Courts, to which the main functions of the ecclesiastical courts were assigned. In the English universities the proctors are two officers chosen from among the masters of arts, to superintend the scholastic exercises, to enforce the statutes, and to preserve the public peace. The name of proctors is also given to the representatives of the inferior clergy and the chapters of cathedrals in convocation.

PROCURATOR, among the Romans, an agent, an overseer of an estate; at a later period the title of a provincial officer inferior to the governor (see PROVINCE and PROCONSUL), who managed the revenue. In some of the small provinces, or in a part of a large province, the procurator discharged the office of a governor, and had the power of punishing capitally, as was the case with Pontius Pilate in Judæa, which was attached to the province of Syria.

Procurator or *proctor*, in monasteries, is the conventual to whom is intrusted the care of the temporal concerns.

Procuratar di San Marco was the title of the chief officers or senators in the Venetian Republic. Besides the nine actual *procuratori*, from among whom the doge was chosen, there were also many titular procurators, who paid a great sum for this title, which was much coveted by the Venetian patricians on account of the rank it conferred.

PROCURATOR-FISCAL, in Scotland, an officer appointed to act as the public prosecutor in criminal cases before the sheriff, magistrates, or justices of the peace belonging to their district. It is only when the public interest is concerned that he ought to originate a prosecution; and when complaint is made by a person in a case in which it is more the private interest of the complainant than the public interest that is at stake it is the duty of the procurator-fiscal merely to give his concurrence to the prosecution, and not to institute the proceedings. He may, however, act as the complainant's agent; but even when he does so, if he only gives his concurrence, he is not liable to an action for malicious prosecution. When information of a crime committed within a procurator-fiscal's district has been laid before him, it is his business to ascertain the truth of the charge, to obtain from the sheriff, or justice of the peace, or some other magistrate, a warrant for the apprehension of the accused, and to see that the warrant is carried out, and in general to do whatever else is necessary to protect the innocent, and have the guilty person brought to justice. All precognitions or preliminary examinations of witnesses are taken by him before the sheriff or sheriff-substitute of the district. The procurator-fiscal has also, in conjunction with the sheriff, to discharge the duties of a coroner in making investigations with regard to persons who are suspected to have met their death from violence, or other than natural causes. The procurators-fiscal of counties are accountable to the crown counsel for the way in which they discharge their duties, and in cases of difficulty it is their duty to communicate with the crown-agent in order that they may have the advice of the crown-counsel. All fines imposed by court are payable to the procurator-fiscal, who

must account for them to the exchequer in cases which have been reported to the crown-counsel, and in other cases to the county and sheriff.

PRODUCTION, Cost of, a phrase used in political economy, not always in the same sense even by the same writer. According to Mill's ultimate analysis of the cost of production of any article, the elements which necessarily enter into the determination of it are the quantity of labour expended upon that article, the wages of that labour, and the profits of the producer; or since the wages of labour are the measure of its quantity as well as of its value, the necessary elements may be reduced to the two, wages and profits. The element of wages includes, however, not merely the amount paid in wages by a producer to his own workmen, but also the wages paid to all the workmen who have been engaged in the preparation of the raw material employed by him, from the state in which it is found in nature to that in which it comes into his hands, and the wages paid to the makers of the machines that he uses, or rather that proportion of those wages that corresponds to the time for which the machines are employed in the production of the article in question. Besides these necessary elements in the cost of production, Mill mentions other two, taxes and any extra cost occasioned by a scarcity value of some of the requisites of production, which occasionally form elements in the whole cost. Mill, with two reservations, excludes rent from the cost of production. 'Rent,' he says, 'is not an element in the cost of production of the commodity which yields it, except in the cases (rather conceivable than actually existing) in which it results from, and represents, a scarcity value. But when land capable of yielding rent in agriculture is applied to some other purpose, the rent which it would have yielded is an element in the cost of production of the commodity which it is employed to produce' (Principles of Pol. Econ., book iii. ch. vi. s. 1).

PRŒTUS, in fabulous history, twin brother of Acrisius, king of Argos. They quarrelled with each other in their mother's womb. Acrisius banished Prœtus from Argos. He fled to Iobates or Amphianax, king of Lycia, married his sister, and by his aid conquered the city of Tiryns, in Argolis, where he founded a small kingdom. Here Bellerophon took refuge with him. His daughters, the Prœtidæ, wandered about through Argolis and Arcadia, having become mad, either on account of their contempt of the mysteries of Bacchus, or of their derision of the statue of Hēra. According to later traditions they imagined themselves cows, and wandered through the fields with wild lowings; the same frenzy seized the other women of Argos also. Two of the daughters of Prœtus were cured by Melampus, who received one of them in marriage. Ovid relates that Prœtus expelled his brother Acrisius from his kingdom, and that Perseus, the grandson of Acrisius, revenged his death by changing Prœtus into stone by showing him the head of Medusa.

PROFANE, an epithet applied in ancient times to uninitiated persons who were not allowed to be present at the sacred services, particularly those of Dēmētēr and Bacchus, but were obliged to remain outside of the temple. The Romans used the word in a wider sense, applying it to the vicious in general. When everything was prepared for the sacrifice, the priest exclaimed, *Profani sacris exeste.* The word was afterwards used by Christians in contradistinction from *sacred*, as *profane* literature.

PROFESSED. See Jesuits.

PROFESSION, the act of taking the vows by the member of a religious order after the novitiate is finished. See Monastic Vows.

PROFESSOR was the name given in the time of the Roman emperors to a public teacher, more especially to one who taught grammar and rhetoric. Such teachers were appointed with fixed salaries in Rome and others of the more important cities of the empire. The name, taken from the Latin verb *profiteri*, denotes that they publicly made themselves known as engaged in the pursuit of their particular art, and in the business of teaching it. In the universities of more modern times it is the title given to those salaried teachers who are appointed to deliver lectures in the four faculties. Those appointed to distinct chairs are in Germany usually called ordinary professors, in contradistinction to extraordinary professors, who are appointed to this rank after they have actively employed themselves for some years as Docents (Magistri Legentes), and satisfied the university teachers as to their qualifications. Recently the teachers of many gymnasiums and other superior training establishments, as conservatories of music, &c., have assumed the title of professor. It has even begun to descend much lower than this, and we now often hear of professors of dancing, cookery, &c.

PROFILE, in general, the view of an object from one of its chief sides, at which more or less of the other side is hidden from the eye; in particular, the contour of the human face viewed from one side. The traits of character are often expressed with peculiar strength in the profile. Only where great symmetry exists, connected with the preponderance of the intellectual over the sensual, will the profile appear finer than the front face. As the profile indicates more particularly the intellectual character of man, it is natural that in children it should be insignificant. In 1818 Professor Blumenbach received from the King of Bavaria a skull of an ancient Greek, found in a tomb of Magna Græcia. It may be considered as a model of the antique Greek profile, in respect of beautiful form. The nose is connected in a straight line with the forehead, and thus would contradict the theory that the profile exhibited in works of ancient Greek art was not an imitation of nature, but merely a style adopted arbitrarily in various schools.

PROFITS, the gains that a person makes by carrying on any production, or engaging in any business. Merchants in keeping their books often make a distinction between the interest on the capital employed in their business and the profits of their business, even though the capital they employ may be all their own. Profits in that case are estimated only after the interest on their capital has been deducted at a fixed rate from the clear returns of the business.

PROGNE, Procne. See Philomela.

PROGRESSION, in algebra, a series of quantities, each of which is obtained from the one before it according to a certain rule. Thus quantities in 'arithmetical progression' increase or decrease by a common difference, as 1, 3, 5, 7, 9, &c., where the common difference is 2; or 30, 27, 24, 21, &c., where the common difference is -3. If a is the first term of an arithmetical progression, l the nth term, d the common difference, we have the following laws, which enable all problems to be solved:—

$$l = a + (n - 1)\,d.$$

$$\text{Sum of } n \text{ terms} = \frac{n}{2}\,(l + a) = \frac{n}{2}\left\{2\,a + (n - 1)\,d\right\}.$$

Quantities are in geometrical progression when the ratio of each to the preceding number is constant, as 1, 2, 4, 8, 16, &c., where the common ratio is 2, or 1, $\frac{1}{3}$, $\frac{1}{9}$, $\frac{1}{27}$, &c., where the common ratio is $\frac{1}{3}$; or a, ar, ar^2, ar^3, &c., where the ratio is r. If a is the first term of a geometrical progression, r the com-

mon ratio, and l the nth term, we have $l = a r^{n-1}$, and the sum of n terms is equal to $\frac{a(r^n - 1)}{r - 1}$, or $\frac{rl - a}{r - 1}$.

Three quantities, A, B, C, are said to be in harmonical progression when $A : C :: A - B : B - C$, and any number of quantities are said to be in harmonical progression when every three consecutive quantities are in harmonical progression. It is easy to prove that the reciprocals of quantities in harmonical progression are in arithmetic progression, and it is by means of this theorem that all problems are solved.

PROHIBITIVE SYSTEM, in political economy, the fostering of certain industries in a country, by imposing on all products of these industries imported into the country such a duty as practically amounts to the prohibition of these imports. See FREE TRADE.

PROJECTILES. When a body is thrown vertically upwards or downwards its motion continues to be rectilinear. (See MECHANICS.) If thrown horizontally, the body will move in a curved path, because it retains unchanged (leaving out of account the resistance of the air) its horizontal velocity, but it falls faster and faster towards the ground. When investigated by dynamics the curved path is found to be a parabola. A body projected obliquely has initially a certain horizontal velocity and a certain vertical velocity. Now it retains its horizontal velocity unchanged, but its vertical velocity is altered by the force of gravity, and we again find the curved path which it follows to be a parabola. With a given velocity the greatest range is obtained by projecting at an angle of 45° with the vertical. We have supposed the air to offer no resistance to the motion of the projectile, but in gunnery this resistance is of very great importance, because of the exceedingly great velocity of a bullet, and indeed in practice the above theory is not of very much use. The path of the bullet is always within the parabola of the theoretical projectile, and hence the range is much less. For example, when the velocity is 2000 feet per second, the resistance of the air is about 100 times the weight of the ball, and the greatest range, which according to theory should be 23 miles, is less than 1 mile.

PROJECTION, in perspective, denotes the appearance or representation of an object on the perspective plane. (See PERSPECTIVE.) The term projection is also applied to the various methods which have been adopted for representing the surface of the sphere upon a plane surface, as in map-making. They are described in the article MAP.

PROLAPSUS ANI, the protrusion of the gut at the fundament. This is most common in children and aged persons, but may happen at any age. It is often the result of straining in evacuation, and not infrequently appears in connection with piles. When such a protrusion takes place the best thing to do is to wash the parts and then replace them with the fingers, which should first be oiled. If this is done at once, and the patient continues in a horizontal posture for some hours afterwards, probably nothing else will be necessary; but if the gut cannot be returned in this way, or continue to fall again after being so returned, surgical aid should be sought. Persons liable to this accident should be careful to regulate their bowels so as to prevent costiveness and consequent straining. Regular bathing of the parts with cold water may also be found useful, as also cold injections into the bowel. A small quantity of a weak solution of sulphate of iron (1 grain of the sulphate to 1 oz. of rain or distilled water) is often recommended for injection in this manner.

PROLAPSUS UTERI, 'falling down of the womb,' or 'bearing down,' a common affection among women who have born large families, especially when they have got up too soon after confinement, and hence most common among women of the lower ranks, who are often obliged to neglect themselves in such circumstances. It is not, however, by any means confined to them, nor even to women who have born children, sometimes occurring in virgins, and in very rare cases in infants. It is not uncommonly the result of straining in consequence of constipation. What renders the falling down of the womb possible is a general laxity of the parts supporting it, either of the ligaments which ought to uphold it or of the vaginal canal. The falling down may be of various degrees, from the slightest downward displacement to such a descent as causes external protrusion of the womb. In the latter case it is called perfect, and in the former imperfect prolapsus. French surgeons distinguish three degrees of the affection. The first is when the womb does not descend lower than 6 centimètres (2⅓ inches) above the vulvar orifice; the second when the orifice of the womb may be seen at the vulva while its lips are distended; the third when there is actual protrusion. In the first two cases the symptoms are less grave than in the third. Leucorrhea and a sensation of fulness or weight, as of a body falling between the great lips of the vulva, are then the principal indications of the affection. Yet the general health is said to suffer more when the prolapsus is slight than when it reaches the third degree. In this last stage the mucous membrane of the vaginal canal, which then covers the prolapsed part of the womb, become wrinkled and ulcerated, the lips of the uterine orifice are partly open and sometimes reflected, the orifice itself becomes ulcerated, and there is an abundant leucorrhea. The bladder and the rectum descend along with the womb, and there is always more or less difficulty in evacuating their contents. When the falling down once begins it always tends to increase, unless means are taken to prevent it. In all cases of this affection the first requisite for cure is prolonged rest in the horizontal position. When the case is mild, and arises from laxity in the walls of the vaginal canal, cold injections repeated night and morning will sometimes be enough to restore the tone of the mucous membrane of the canal, and enable it to support the womb. From half a pint to a pint of water may be injected on each occasion, and the injection should be made very slowly by means of an elastic bottle. When the simple cold injections are not enough, astringent injections are sometimes resorted to when there is no congestion or inflammation of the parts. When the womb protrudes it must be restored to its position. Sometimes this is impossible, and no remedy remains but to remove the organ altogether. When it has been restored to its place it must be retained there by mechanical means, such as a pessary or a compress and bandage.

PROLEGOMENA (Greek), preliminary observations, serving as an introduction to a work, to which they are prefixed, and containing historical, critical, &c., illustrations of its contents, language, form, &c.

PROLETARII, the name which was given to those Roman citizens who, in the classification of their means by Servius Tullius, stood in the sixth class, possessing less than 1500 asses, or nothing at all. They were ever afterwards distinguished by the name of *capite censi*, apparently because having too little means to be taxed on it, they were taxed only by *head*. The term has been revived in modern times as a designation of the lowest class of the community; but more frequently the collective appellation proletariat is used.

PROLOGUE, in dramatic poetry, an address to the audience which precedes the piece itself. It may be either in prose or verse, and is usually pronounced by one person. Among the ancients, the player who delivered this address was called the *prologus*, and was usually considered as a person of the drama. Thus, in the Amphitryon of Plautus Mercury appears as prologus. Prologues sometimes relate to the drama itself, and serve to explain to the audience some circumstances of the action, sometimes to the situation in which the author or actor stands to the public, and sometimes have no immediate connection with either of these persons or subjects. From the epilogue to As You Like It, it appears to have been the custom in Shakspere's time for the prologue to be spoken by one of the actors who took a female part, and the epilogue by one who took a male part.

PROMETHEUS, a Titan, son of Iapetus and Clymene, a daughter of Oceanus; Æschylus makes Themis, Apollodorus Asia, his mother. He was the brother of Atlas, Menœtius, and Epimetheus, and the father of Deucalion. His name means 'forethought,' as that of his brother Epimetheus signifies 'afterthought.' Cunning and fertile in expedients he opposed Zeus, the founder of the new race of the gods, whom he had at first supported. Zeus, who despised poor mortals, determined to extirpate them, and create a new race. But Prometheus prevented him, by secretly bestowing on men the fire which had been concealed by Zeus, and teaching them the arts. To punish this offence Zeus sent down Pandora, who brought all kinds of diseases into the world. He caused Prometheus himself to be chained by Hephæstus on a rock of the Caucasus (the eastern extremity of the world, according to the notions of the earlier Greeks), where his liver, which was renewed every night, was torn by a vulture or an eagle. But Prometheus, knowing that from Io's race would spring a man (Heracles), who, after having encountered innumerable hardships, would deliver him from his chains, suffered with heroic firmness; he was even acquainted with the future fate of Zeus, which was unknown to the god himself. When the irresistible enemy of Zeus, generated by himself and Thetis, should appear, then Prometheus was to find a termination of his sufferings. Zeus must then be reconciled to him, because his fall could only be prevented by the counsels of Prometheus. These are evidently two traditions united by Æschylus. The cause of Zeus's anger against mortals, and determination to destroy them, is thus related by Hesiod. The gods once attempted to make an agreement with men at Mecone (afterwards Sicyon), the object of which was to determine what honours the gods should enjoy, and what duties men should owe them for their protection. Prometheus appeared for men, that the gods might not impose too burdensome duties upon them in return for their protection. A bull was brought as an offering, from which the gods were to select what portion they chose for their share. After it was cut up Prometheus formed two heaps; in the one he placed the flesh and the fat entrails, wrapped in the skin of the bull, and covered with the stomach (considered the worst piece); in the other pile he placed the bones artfully concealed in the fat. Zeus, who did not see through the trick, chose for the gods, and selected the fat, in which he was indignant to find only the bones. Hesiod adds that from that time it became the custom to offer to the gods bones without flesh. In Lucian's dialogue, called Prometheus, Prometheus is accused not only of this division of the flesh, and of stealing the fire, but also of having created man. According to Apollodorus he formed man of clay and water, and bestowed on him fire, by kindling dry wood at the sun. Plato relates that the gods had made the races of animals from earth and fire, but that they left to Prometheus and his brother Epimetheus (the husband of Pandora), to arrange the proportion in which these materials should be assigned to each. Epimetheus had distributed the best powers among the irrational animals, and Prometheus, that man might not be left altogether helpless, obtained for them by stealth from Hephæstus and Athena the arts of fire. Others, poets as well as philosophers, have modified this mythus, according to their particular object.

PROMINENCES, Coloured. In total eclipses of the sun immense prominences, tinted of a delicate rose-red, show themselves past the moon's limbs. Some of them are more than 80,000 miles in height. From spectroscopic observation of the eclipse of 1868 it was supposed that these prominences consisted of glowing hydrogen. Lockyer, in 1866, had suggested a means of observing the prominences at any time, but he did not get the use of proper instruments till 1868. In that year, after the eclipse, Lockyer (in London) and Janssen (in India) discovered independently that the prominences may be viewed in a telescope with a spectroscope attached which has a wide slit. It has been found that the prominences are detached elevations of hydrogen, a thick continuous stratum of which surrounds the sun. The rapid changes which take place in these prominences are very startling when we consider their enormous size. The following description of a change of form was observed by Professor Young. 'It [a prominence of hydrogen] had remained, with very little change, since the preceding noon—a long, low, quiet-looking cloud, not very dense or brilliant, nor in any way remarkable except for its size. It was made up mostly of filaments nearly horizontal, and floated above the chromosphere [see Sun] with its lower surface at a height of some 15,000 miles, but was connected to it, as is usually the case, by three or four vertical columns brighter and more active than the rest. Lockyer compares such masses to a banyan grove. In length it measures 3′ 35″, and in elevation about 2′ to its upper surface—that is, since at the sun's distance 1″ equals 450 miles nearly, it was about 100,000 miles long by 54,000 high. At 12·30, when I was called away for a few minutes, there was no indication of what was about to happen, except that one of the connecting stems at the southern extremity of the cloud had grown considerably brighter, and was curiously bent to one side; and near the base of another, at the northern end, a little brilliant lump had developed itself, shaped like a summer thunder-head. . . . What was my surprise, then, on returning in less than half an hour (at 12·55), to find that in the meantime the whole thing had been literally blown to shreds by some inconceivable uprush from beneath. In place of the quiet cloud I had left, the air, if I may use the expression, was filled with flying *débris*—a mass of detached vertical fusiform filaments, each from 10″ to 30″ long by 2″ or 3″ wide, brighter and closer together where the pillars had formerly stood, and rapidly ascending. When I first looked some of them had already reached a height of nearly 4′ (100,000 miles), and while I watched them they rose with a motion almost perceptible to the eye, until in ten minutes the uppermost were more than 200,000 miles above the solar surface. . . . As the filaments rose they gradually faded away like a dissolving cloud, and at 1·15 only a few filmy wisps, with some brighter streamers low down near the chromosphere, remained to mark the place. But in the meanwhile the little 'thunder-head' before alluded to had grown and developed wonderfully, into a mass of rolling and ever-changing flame, to speak according to appearances. First it was crowded

down, as it were, along the solar surface; later it rose almost pyramidally 50,000 miles in height; then its summit was drawn out into long filaments and threads, which were most curiously rolled backwards and downwards like the volutes of an Ionic capital; and finally it faded away, and by 2·30 had vanished like the other.'

PROMISE, an engagement entered into by one person to perform or not perform some particular thing. When there is a mutual promise between two parties it is termed a contract. A promise may either be verbal or written. A verbal promise is in England called a promise by parole, and a written promise is in technical language there called a covenant. By English law no promise is binding unless it was made for a consideration, but by Scotch law it is always binding whether a consideration was given or not. The law of Scotland makes a distinction between a promise and an offer, the former being an engagement of such a nature that the promiser thinks it unnecessary to secure the consent of the person to whom the promise is made, while the latter is an engagement dependent on the assent of the other party. A promise is binding from the first, but an offer is not binding until it is accepted, and if not previously accepted may be at any time withdrawn. In ordinary cases an offer, unless withdrawn, may also be accepted at any time; but with mercantile transactions a different rule is observed. An offer to buy or sell must be accepted by the person to whom it is made without undue delay, and while no change has taken place in the market disadvantageous to the offerer, otherwise he is no longer bound. When an offer is made, and it is stated that an answer is expected by return of post, the offerer is not bound after the arrival of that post without an acceptance. If the answer is expected from abroad it is held to be by return of post if it is sent by the first mail packet, even though private ships may have sailed previously. In case of a promise to marry, which is a mutual promise, either party, as is very well known, may sue for damages in case of the non-fulfilment of it.

PROMISSORY NOTE. See BILL OF EXCHANGE.

PRONOUN, a part of speech which resembles the noun in being used to designate a person, animal, or thing, but which differs from a noun in that it neither designates its object like a common noun, in virtue of the qualities which it possesses, nor, like a proper noun, always designates the same object, but designates different objects according to the circumstances in which it is used. A pronoun, in fact, has no connotation and no fixed denotation. The first personal pronouns, *I*, *we*, denote the person speaking or those represented by the person speaking; the second, *thou*, *you*, denote the person or persons spoken to; and the third personal pronouns, *he*, *she*, *it*, *they*, the person or persons or things spoken about. Demonstrative pronouns are those which relate to a present subject, as *this*, *that;* relative refer to some subject previously mentioned, as *who*, *which;* interrogative refer to some unknown subject; possessive indicate possession, as *mine*, *his*. Pronouns compounded with *self* or *selves* (as *myself*, *yourself*, *yourselves*) are usually called reflexive or reflective, but are as often intensive as reflexive. *One* in such a phrase as 'One would think so-and-so' may be called an indefinite pronoun. In English the form *its* is of comparatively recent origin. It does not once occur in Spenser, nor in the original (1611) edition of the Authorized Version of the Bible, though it is now to be found in Levit. xxv. 5; and it is not mentioned by the grammarian Alexander Gil (1619). It occurs but seldom in Shakspere, and the first grammarian who recognizes it is John Wallis in 1653. In most languages there are certain anomalies worthy of attention in the use of the pronouns. It is a general practice with sovereigns in all formal documents or proclamations to make use of the first person plural instead of the singular, and the same is the case with editors of newspapers and even to a large extent with authors. Most modern languages have dropped the singular of the second personal pronoun in ordinary social intercourse. In English and French the plural of the second personal pronoun is generally substituted, and the singular is now reserved almost exclusively as the mode of addressing the Deity. In English it is still sometimes used also in elevated style, and was formerly frequently used in addressing inferiors, as is common in Shakspere. In French it is sometimes used between intimate friends. The Germans use in ordinary intercourse the plural of the third person (*sie*) instead of the second person singular, which is reserved for the Deity, intimate friends, inferiors, and children. In Italian the ordinary mode of address is the feminine of the third personal pronoun (*ella*), which is taken to be equivalent to addressing every person as 'your excellence' (*vostra eccellenza*).

PRONUBA. See JUNO.

PRONUNCIAMENTO, in Spain and the American republics where Spanish is spoken, a proclamation against the existing government, intended to serve as a signal of revolt. These risings are mostly the work of discontented officers, and hence are in the main of a military character; but they sometimes originate with civil bodies or individual towns and communes. The word *contrepronunciamento*, that is, counter-proclamation, also occurs.

PROOF. See EVIDENCE.

PROOF IMPRESSION. See CORRECTION OF THE PRESS.

PROOF PLANE, a small, thin, metallic disc insulated on a long stem of glass or vulcanite. A charge of electricity may be carried on it from one place to another. Coulomb employed it in his experiments on the distribution of electricity on conductors. When it is laid against the surface whose electric density we wish to measure, it forms, as it were, a part of the surface, and takes the charge due to the area which it covers; this charge may now be carried away to an electrometer and tested. Coulomb investigated the action of the proof plane. See also Clerk Maxwell's Electricity, sect. 223.

PROPÆDEUTICS (*propaideuō*, to prepare for instruction), a term first used by the Germans to indicate the knowledge which is necessary or useful for understanding or practising an art or science, or which unfolds its nature and extent and the method of learning it. It is applied, therefore, not only to special introductions to particular branches of study, but also to auxiliary sciences, logic, philology, &c., and the encyclopædic views of particular branches of science which facilitate an insight into the relations of the parts. Such a survey can be presented only by one who has studied a science in all its ramifications. The term *propædeutics* is often of course merely relative: thus philology belongs to the propædeutics of history, while it is itself the main study of a certain class of scholars. The term, however, in its common use is generally restricted to the body of knowledge and of rules necessary for the study of some particular science—rules which originate in the application of the general laws of science or art to a particular department. Thus we find in the catalogues of lectures to be delivered in German universities medical propædeutics, &c., enumerated.

PROPAGANDA, a name generally given to those institutions by which Christianity is propagated in heathen countries, more particularly to those which

were established in the seventeenth century, and especially that erected by the Papal court for the extension of its own power and the Catholic religion among those who were not Christians or Catholics. It is called the *congregatio de propaganda fide* (society for propagating the faith), and was founded by Gregory XV. in 1622. It consists of eighteen cardinals and some Papal ministers and officers of the college, and its object is to arrange and direct all measures relating to the extension of the Catholic faith and the extirpation of heretics. Connected with this is the *collegium seu seminarium de propaganda fide*, instituted by Urban VIII. (1627) for the education of missionaries. The congregation formerly met once a week in presence of the pope, but now it meets only once a month. There are, however, weekly meetings for consultation among the superiors of the congregation. Converts to the Catholic Church who have come to Rome are instructed and supported by them. Bishops and other clergy who have been expelled are also received and supported. The Roman Propaganda has a fine palace and a printing-press, celebrated for the numerous works which issue from it. Thence breviaries and missals are sent to all parts. The efforts of the propaganda are directed towards the whole of the church *in partibus infidelium* in general, but more particularly to the non-Catholic parts of Northern Europe, and, above all, England and Germany. All the countries of the earth are divided by it into provinces. In close connection with it stand the seminaries or colleges of the Jesuits, such as the Collegium Germanicum and Collegium Hungaricum in Rome, and the Collegium Helveticum in Milan. The great majority of the members of the propaganda are Jesuits and Franciscans. The means of communication between the bishops and the propaganda are the archbishops, or where there are no archbishops the permanent nuncii or specially appointed Papal delegates. Reports relating to the whole field of operations of the congregation are periodically drawn up on a uniform plan. In the time of the French revolution secret societies, whose object was the propagation of democratical principles, were called *propagandas*. Propaganda has therefore come to signify any kind of institution for making proselytes.

PROPAGATION OF PLANTS. The most common method of propagating plants is of course by their seed. There are other ways, however, by which plants are propagated naturally. Some, for example, throw off runners from their stems which creep along the ground, and these runners take root at the buds, and send up new plants, which may be separated from the parent plants by cutting through the runners. Others throw off suckers from the root, and new plants are produced by them in the same way as when they proceed from the stems. The commonest artificial methods of propagating plants are budding, layering, the various forms of grafting, including inarching or grafting by approach, propagation by offsets and by slips—all of which methods are described in separate articles. Some plants (as the potato) are propagated by dividing the tubers or underground stems, each 'eye' or leaf-bud of which sends up a new plant. A few are propagated by cuttings of the leaves, which are either obtained by slipping off the petiole from the parent plant, or by taking fragments of the fleshy parts of the leaves themselves, as may be done in the case of the begonias and gloxinias.

PROPER NAMES. See NAMES.

PROPERTIUS, SEXTUS AURELIUS, a Latin elegiac poet, born in Umbria, near the borders of Etruria. Little is known of his life. The date of his birth has been variously given between 57 and 46 B.C. The latter date is, however, extremely improbable. After the end of the civil war he found a patron at Rome in Mæcenas, through whom he obtained the favour of the emperor. He appears to have been the bosom friend of Ovid, to have lived mostly in Rome, in the enjoyments of love and poetry, and to have died there in the prime of life (about 12 years B.C.) He did not possess the natural ease and grace of Ovid and Tibullus, but is distinguished for his art and ingenuity and the brilliancy of his style. He is particularly happy in his description of heroic scenes. We have four books of his elegies. The last of the fourth book is the most highly esteemed, and is often called the 'queen of elegies;' yet it is not wholly free from the usual fault of the author—a straining after originality of expression. Love is the subject of many of his elegies, but not a noble, spiritual love, which, indeed, we must not look for in any Roman poet of that age, although all were not so entirely abandoned as Propertius to licentious descriptions. There are also in the fourth book several poems which, although written in the elegiac measure, yet, from their subjects, belong to the class of didactic and narrative poems. He makes a display of his learning when he handles subjects of mythology, and therefore affects our feelings less. In general he imitates the Grecian elegiac poets, particularly Callimachus the Alexandrian. The elegies of Propertius are usually published with the poems of Tibullus and Catullus. The best editions are Broekhuizen (Amsterdam, 1702 and 1727, 4to), Vulpius (Padua, 1755, two vols.), Burmann and Santen (Utrecht, 1780, 4to), and Haupt (Leipzig, 1853). There are large critical editions, with a commentary, by Lachmann (Leipzig, 1816, and Berlin, 1829), and by Hertzberg (Halle, 1843–45).

PROPHETS, among the Hebrews, inspired teachers sent by God to declare his purposes to his people. The ordinary Hebrew word for a prophet is *nâbhi*, which by the majority of Biblical critics is interpreted as 'the one who pours forth or announces,' namely, the declarations of God. There are two other words used in the Old Testament as appellations of prophets. These are *roëh* and *chozeh*, both of which literally signify seer, and are uniformly so translated in the Authorized Version of the Scriptures. The word *roëh*, which only occurs ten times, is seven times applied to Samuel. It has been made a subject of dispute whether these words denoted separate classes of prophets, and if so, what is the class that each of them denotes; but it seems most likely that all the three words were used as designations of the same class, but applied to them in virtue of different attributes possessed alike by all. In the Septuagint the word *nâbhi* is always rendered *prophētēs*, and in the Authorized Version *prophet*. The literal signification of this word is 'one who speaks for another;' but the word was generally used as meaning 'one who speaks for a god;' and it is in this sense of the word that it is applied to the Hebrew prophets, who were in general the messengers of God, both as revealing and as expounding his will. In one common acceptation of the word its sense has become narrowed to that of a 'foreteller of future events,' and this restriction of the meaning, which naturally resulted from one of the chief functions of the prophets as revealers of the will of God with regard to the future, had already taken place in the Greek word before it was introduced into English. But the wider acceptation still remains side by side with this narrower one, otherwise it could not embrace all those to whom the term is usually applied. In Ex. vii. 1, where it is said that Aaron shall be the prophet of Moses, the word seems to mean simply 'spokesman.'

Moses is the first who is referred to as a prophet

in the usual sense of the term (Deut. xviii. 15). Among those who in other parts of the Old Testament are spoken of as having or claiming prophetic powers are three prophetesses—Deborah (Judg. iv. 4), Huldah (2 Kings xxii. 14), and Noadiah (Neh. vi. 14). In the New Testament a prophetess called Anna is mentioned in Luke ii. 36; 'virgins which did prophesy' are spoken of in Acts xxi. 9; and in Rev. ii. 20 is mentioned a woman, Jezebel, who called herself a prophetess.

From the time of Samuel frequent mention is made of a body of men bearing the general name of prophets, although we have no reason to believe that they were all specially called as the messengers of God. They were members of the schools of the prophets, in which young men of all the tribes were instructed in the law, and apparently also in sacred poetry and music, for all the prophetical authors of the Bible write in poetry, and on many occasions the members of the schools of the prophets are spoken of as playing on musical instruments. The first school of this nature appears to have been set up by Samuel at Ramah. Others were afterwards formed at Bethel, Jericho, Gilgal, and elsewhere. The members of these schools are usually spoken of collectively as the prophetic order among the Jews. The circumstance to which the institution of this order was no doubt due was the declension of the priesthood in the time of Samuel, and its object was to strengthen the attachment of the Jews to their religion, from which they had in a great measure fallen away, and to maintain that religion pure. From 2 Kings iv. 23, where the husband of the Shunamite woman who had lost her son by sunstroke represents to her the uselessness of visiting the man of God then, because it was neither new moon nor Sabbath, it would seem that the prophets were in the habit of holding weekly and monthly meetings. The prophetic order seems to have continued in existence down to the close of the Old Testament canon. The apocryphal books of the Maccabees and Ecclesiasticus speak of it as extinct.

It has been stated already that to be a member of the prophetic order did not imply any divine call to serve as a messenger of God to his people; but there are a few who are mentioned by name and are presented to us as acting in this capacity, divinely-inspired seers, who in an especial manner purified and exalted the religion and morality of their nation, defended the Mosaic theocracy against the encroachment of the kings and the laxity of the priests, and foretold the fate of states, with warnings, denunciations, and consolatory prophecies. Of these divine messengers sixteen are the writers of books that are admitted into the Old Testament canon. Four of these, Isaiah, Jeremiah, Ezekiel, and Daniel, are usually called the great prophets, and the remaining twelve, Hosea, Joel, Amos, Obadiah, Jonah, Micah, Nahum, Habakkuk, Zephaniah, Haggai, Zechariah, Malachi, are called the minor prophets. These cannot with certainty be arranged in chronological order, and different arrangements have been given by those who have attempted to do so. They may, however, be divided into four groups in such a manner as to give us a partial chronological arrangement. First, there are three prophets who belonged to the Kingdom of Israel as distinct from that of Judah—Hosea, Amos, Jonah; secondly, there are eight prophets of the Kingdom of Judah—Joel, Isaiah, Jeremiah, Obadiah, Micah, Nahum, Habakkuk, Zephaniah; thirdly, two prophets of the captivity—Ezekiel and Daniel; and fourthly, three prophets of the return—Haggai, Zechariah, and Malachi. To the first group belong also Elijah and Elisha, the two great prophets, who are not the authors of any books in the canon. In each of these four groups the prophets are named in chronological order according to one arrangement. It is not unlikely that the majority of these canonical prophets proceeded from the schools of the prophets, but from the nature of their mission it was not necessary that they should do so; and the declaration of Amos, 'I was no prophet, neither was I a prophet's son' (chap. vii. 14) is commonly, and no doubt correctly, understood as meaning that he did not belong to the prophetic order.

It has already been stated that it was one of the obligations of the prophetic calling to defend the Mosaic theocracy and the purity of religion against the laxity of the priests, who, being occupied merely with religious rites, were apt to exaggerate the importance of mere outward observance of the law, in opposition to which the prophets constantly maintain, as all exalted moral teachers must, the preeminent value only of essentials, sincerity of heart and uprightness of conduct. From this circumstance some have drawn the conclusion that there was an antagonism between the prophetic order generally and the priesthood as such; but this inference has been justly objected to as unwarranted. It was to be expected that the reproaches and exhortations of the prophets would be as much addressed to a degenerate and narrow priesthood as to a degenerate people. The patriotism which strongly characterizes all the Hebrew prophets was closely connected with their religious zeal. The Jewish people being the chosen of God and the immediate subjects of the divine ruler all the nations hostile to the Jews were necessarily the enemies of God. They might be his instruments in punishing and disciplining the Jewish people, but they were not the conscious and willing instruments, and the Jews could be allowed to fall under their power only in consequence of their own wickedness and apostasy. Hence it is the constant cry of the prophets that the people should turn to righteousness in order to be delivered from the hands of their enemies.

The predictive powers of the prophets have been the occasion of much controversy. The ability of the prophets to foretel the future was universally believed in by the Jews, and in one passage of the Old Testament is made a negative test of the justness of a person's claim to be a prophet. In Deut. xviii. 22 we read, 'When a prophet speaketh in the name of the Lord, if the thing follow not, nor come to pass, that is the thing which the Lord hath not spoken, but the prophet hath spoken it presumptuously, thou shalt not be afraid of him.' On the other hand, the Jews are expressly warned in the beginning of the thirteenth chapter of the same book against taking the coincidence of an event with a prediction of a prophet as in itself evidence of the trustworthiness of the prophet. The main controversies with regard to this predictive power turn upon two points—first, the reality of the power, which is by some altogether denied; and secondly, the reference of the prophecies. Numerous works have been written with the sole object of confuting the first class of objectors, in order to do which successfully three things must be established: first, the fact of certain predictions having been made at a period so far antecedent to the events to which they relate as to make it incredible that those events could have been foreseen by any mere human sagacity; secondly, that the events did actually take place as foretold; and thirdly, that this correspondence of the event with the prediction cannot reasonably be set down as a mere coincidence. With regard to the reference of the prophecies the chief controversy is connected with the body of predictions scattered through all the prophetical writings of the Old Testament supposed to relate to the Messiah. With relation to these prophecies three different positions are

taken up by different schools of Biblical critics. Those who deny to the prophets the power of foretelling future events altogether necessarily deny also the reference of the prophecies in question to Christ as the Messiah, but refer all the passages which are supposed to point to the coming Messiah to historical events which happened at the time that the prophecies were uttered. Another school of critics, while admitting the reference of at least some of the passages to such historical events, contend that this is not the only bearing of the prophecies, which have thus a double reference, first, to these events of the time of the prophets, and secondly, to the Messiah. The third school, finally, hold that none but the Messianic interpretation is permissible. The nature and extent of the controversies that have been waged on this subject may be in some measure gauged by the divisions which exist among commentators with regard to one of the principal of the so-called Messianic prophecies, the fifty-third chapter of Isaiah. The ancient Jews understood this chapter as relating to the Messiah, but in modern times the Jews have been forced to abandon this view, and their chief expositors (Jarchi, Abenezra, Lipmann, &c.) refer it to the Israelitish people. Among Christians it was universally applied to Christ as the Messiah until the time of Grotius, who maintained that it ought to be understood of Jeremiah. Eichhorn, Rosenmüller, Köster, and others follow the modern Jewish interpretation. Eckermann, Ewald, and Bleek think that the ideal Israelitish people is figured in it. Knobel and others apply it to the godly portion of the Israelitish people. De Wette, Gesenius, Schenkel, and others believe it to refer to the prophetical body. Other commentators take it to point to King Uzziah, Hezekiah, the house of David, or Isaiah himself. And lastly, the Messianic interpretation is adopted by a large number of Biblical students, among the chief of whom are Michaelis, Reinke, Tholuck, and Stier.

Another subject of controversy with reference to the Hebrew prophets as the messengers of God is the state in which they were while receiving and uttering their divine communications. According to the Alexandrian Jews and the Montanists (see MONTANUS) they were in a state of ecstasy in both cases, that is to say, they lost all individual consciousness, power of independent volition, and became merely passive instruments of the divine spirit. When the divine spirit enters a human body, such theorists held, the human understanding must take its departure, for the mortal and the immortal cannot dwell together. This view was also that of the heathen, but was rejected by the early Christians, who considered that the Hebrew prophets spoke in a calm and sober state of the understanding, and were by this circumstance distinguished from heathen soothsayers. What appears to be the prevailing modern view on the subject is that in many, or perhaps in most cases, the divine communication or impulse came to the prophets while in their ordinary waking state, but that at other times they were received in the form of dreams or visions while the prophets were in a kind of trance or ecstasy. It follows from this that the prophets would not necessarily understand the full import of what had been revealed to them, even when they had recovered from the trance in which they were temporarily plunged, and began to exercise their reflective faculties on the divine communications.

Besides the prophets of the Old Testament, prophets and persons claiming to be prophets occur in the early history of the Christian Church. Thus the Acts of the Apostles records two appearances of a prophet named Agabus, who on the first occasion foretold a famine (Acts xi. 28), and on the second occasion warned Paul of his danger in going up to Jerusalem (Acts xxi. 10). There are also in the New Testament the prophetesses already mentioned. The gift of prophecy is likewise mentioned as one of the Christian graces in Rom. xii. 6; 1 Cor. xii. 10; xiv. 37, 39. About the middle of the second century the Montanists especially boasted of their prophets (Montanus, Maximilla, Priscilla, &c.), who professed to be selected as the instruments of the Holy Spirit to guide the church and to prepare it for the second coming of Christ. In modern times religious fanatics have frequently pretended to be prophets without being able to demonstrate their claims to the title. The seventeenth century in particular was fruitful in prophets and prophetesses, and even in the beginning of the eighteenth century the prophets of the Cevennes excited a temporary attention. They were called in England the 'French prophets.' The subjects of their prophecies were the appearance of antichrist, judgments against the city of London, &c. They were condemned, as false prophets and disturbers of the public peace, to fines and to the pillory.

The following are a few of the principal works on the Hebrew prophets:—Lowth, De Sacra Poesi Hebræorum (Oxford, 1821), translated by Gregory (London, 1835); Davison, Discourses on Prophecy (Oxford, 1839); Eichhorn, Die hebräischen Propheten (Göttingen, 1816); Knobel, Der Prophetismus der Hebräer (Breslau, 1837); Hofmann, Weissagung und Erfüllung im alten und neuen Testament (Nördlingen, 1841); Hengstenberg, Christology of the Old Testament, translated (Edinburgh, 1854); Lee, Inspiration of Holy Scripture (London, 1857); Pusey, The Minor Prophets (Oxford, 1861); R. Payne Smith, Messianic Interpretation of the Prophecies of Isaiah (Oxford, 1862); Davidson, Introduction to the Old Testament (London, 1862); Stanley, Lectures on the Jewish Church (London, 1863). See also the article Prophet in Smith's Dictionary of the Bible, from which the bulk of our information is taken.

PROPOLIS. See BEE.

PROPONTIS (so called by the ancients from being before the Pontus Euxinus or Black Sea), the sea lying between the Ægean and the Black Seas, and connected with them by the Hellespont and the Thracian Bosporus; now called, from the largest of its islands, the Sea of Marmora.

PROPORTION, the equality of two ratios. Euclid's definitions of ratio and proportion are shown to accord with the more simple algebraic definitions, and the fifth book of Euclid, which was devoted to ratio and proportion, is now superseded by a few easy algebraic propositions. Ratio, in algebra, is expressed as a quotient or fraction. Proportion is expressed by the equality of two fractions; in short, by an ordinary equation. Thus the proportion a is to b as c is to d may be expressed in the forms $a:b::c:d$, or $a:b = c:d$, or $\frac{a}{b} = \frac{c}{d}$, or, as algebra teaches, $ad = cb$. Thus we have at once a most important property; if four quantities are proportionals, the product of the extremes is equal to the product of the means. We see also that if $a:b::c:d$, then $a:c::b:d$, and so on, such changes in arrangement being possible because of the equality $ad = cb$. Quantities a, b, c, d, &c., are said to be in continued proportion when $a:b::b:c::c:d$, &c. In this case $ac = b^2$, and b is said to be a 'mean' between a and c. It is easy to show that $\frac{a}{c} = \left(\frac{a}{b}\right)^2$, and the ratio of a to c is said to be the 'duplicate' ratio of a to b. Also as $\frac{a}{b} = \sqrt{\frac{a}{c}}$, the ratio of a to b is said to be the sub-duplicate ratio of a to c. In algebra, when

quantities are in continued proportion, they are said to form a geometrical progression.

PROPOSITION. See LOGIC—Judgments.

PROPRÆTOR. See PROCONSUL.

PROPYL and its derivatives. Propyl (C_3H_7) is the third radicle of the series $C_n H_{2n+1}$. It does not exist in the free state, but enters into the composition of a large series of important compounds.

Propyl alcohol (C_3H_7OH). There are two alcohols of this name—the *normal alcohol*, obtained from fusel-oil, and the *iso-alcohol*, which may be obtained from ethyl alcohol. Derivatives of these two alcohols are known. Thus we have *normal propyl chloride*, C_3H_7Cl, and *iso-propyl chloride*, &c. The difference between the two series is generally shown by such formulæ as these—

Normal Alcohol.	Iso-alcohol.
$CH_3—CH_2—CH_2OH.$	$CH_3—CHOH-CH_3.$

By replacing part of the hydrogen in ammonia by the radicle propyl we obtain *propylanine* $N\left\{\begin{matrix}C_3H_7,\\H_2\end{matrix}\right.$ which is a strongly alkaline liquid. Two propylanines are known, namely, *normal* or $N\left\{\begin{matrix}CH_2CH_2CH_3,\\H_2\end{matrix}\right.$ and *iso-* or $N\left\{\begin{matrix}CH(CH_3)_2\\H_2\end{matrix}\right.$.

PROPYLÆA (Greek), in Greek architecture, the entrance to a temple. The term was employed particularly in speaking of the superb vestibules or porticoes conducting to the Acropolis or citadel of Athens, which formed one of the principal ornaments of the city. This magnificent work, of the Doric order, was constructed by Pericles (B.C. 437–433) after the designs of Mnesicles, one of the most celebrated architects of his age. Pausanias says it was covered with white marble, remarkable for the size of the blocks and the beauty of the workmanship. Stuart, in his Antiquities of Athens; Le Roy, in his Ruins of Greece; and the Travels of Anacharsis the Younger, mention the relics of the propylæa.

PROROGATION OF PARLIAMENT, the continuance of Parliament from one session to another, as adjournment is a continuance of the session from one day to another, or for a longer period. Prorogation determines the session; but adjournment, though for a fortnight, month, &c., does not. After a prorogation any bill which has previously passed both houses, or either house, without receiving the royal sanction or the concurrence of the other house, must be taken up *de novo*. Parliament is prorogued by the queen in person, or by her commissioners, headed by the lord-chancellor; or it may be done simply by proclamation.

PROSCENIUM, in Greek and Roman theatres, the place before the scene where the actors appeared, corresponding to what we call the stage. The front part of it, where the actors stood, was called in Greek *logeion* or *ocribas*, and in Latin *pulpitum*, and was coloured red by being sprinkled with crocus-water, for the sake of the perfume. It was somewhat higher than the orchestra, which was in front of it. The place behind the scene, where the actors dressed and undressed, was called *postscenium*. Projecting wings on each side of the proscenium were called *parascenia*.

PROSCRIPTION, in Roman history, a mode of getting rid of enemies, first resorted to by Sulla in 82 B.C., and imitated more than once afterwards in the stormy years that closed the republic. It literally signifies 'a writing before,' and commonly meant an advertisement or announcement of articles to be sold. But Sulla applied it to lists of names which he posted up in public places, with the promise of a reward to any person who should kill any of those named in the lists, and the threat of death to those who should aid or shelter any of them. The persons named were said to be proscribed. Their property was confiscated and retained by Sulla, or distributed among his friends, and their children were declared incapable of honours. The most notorious proscription after that of Sulla (in which thousands of the noblest of Rome perished) was that of the second triumvirate—Antony, Octavius Cæsar, and Lepidus (B.C. 43), in which Cicero was among those who lost their lives.

PROSE (generally derived from *prorsa (oratio)*, the reason of which will be given in the course of the article). The true character of prose can be clearly conceived only by considering it in relation to poetry. Their difference lies in the essential difference of certain states of the mind and feelings. The two chief states of the inward man may be called the *thinking* and the *poetical* states, and depend upon the predominance of the understanding, or the imagination and feelings. If we think (in the narrower sense of the word) we combine ideas according to the laws of reason; and prose, which is the language of sober thought, is characterized by the abstractness and generality of precision belonging to ideas that occupy the understanding. Prose, in the most common acceptation of the word, is used in contradistinction to metrical composition. The external form naturally strikes first, and in the early stages of society strikes most; hence the term *prose*, which, as we have already stated, is generally derived from *prorsus*, *prorsa oratio* (progressive speech), opposed to *verse*, which is derived from *versus* (turned), returning always to the selected metre. The Greeks called prose *ho pezos logos*, which the Romans translated *pedestris oratio;* and St. Evremond compares prose writers to modest pedestrians. Prose was also called by the Romans *oratio soluta* (free speech), in opposition to *oratio vincta* (bound speech) or verse, which is bound by rhythmical laws. From what has been said of the difference between prose and poetry it is clear that poetry must be much earlier developed than prose. Strong personal feeling naturally demands rhythmical expression, and in the early stages of society such is the only motive that is capable of leading to literary production. Oratory, it is true, selects a prose vehicle; but there is this difference between oratory and poetry, that the orator rather governs his feelings and directs them towards a practical object—that of inciting his hearers to some resolution—than allows himself to be swayed by them; whereas the poet allows himself to be swayed so far as is consistent with literary expression. Whenever the understanding predominates, as it does in oratory, prose is the natural vehicle; and although it is the case that histories, laws, and philosophical maxims were first conveyed in verse with the Greeks and many other nations, this may be explained partly by the fact that verse had established itself as the regular literary medium, and partly by this, that in these early times civilization was not sufficiently far advanced for the purely intellectual to be predominant over the emotional interest except in the one case of oratory. Pliny says that Pherecydes of Scyros (a contemporary of Cyrus) first formed the Greek prose (*prosam primus condere instituit*); but perhaps he was only the first who wrote on philosophico-mythological subjects in prose. Fine prose is among the latest attainments both of nations and individuals, and it would appear that with most nations classical prose writers are fewer than classical poets.

PROSECUTION, CRIMINAL. There is an important difference, according to English and Scotch law, in the method of originating a criminal prosecution. By the law of England there is no public prosecutor

whose duty it is to institute proceedings in a criminal prosecution in all cases where the public interest is mainly concerned; while by the law of Scotland that function is assigned to the lord-advocate and his assistants, the advocates-depute and the procurators-fiscal of burghs and counties. There is indeed a public prosecutor in England, the attorney-general; but he prosecutes only in the case of political offences and crimes of peculiar enormity. In other cases it is left to the private parties more immediately concerned to institute criminal proceedings. The result of this is that many criminals are allowed to go free merely from want of a prosecutor, for the inevitable loss and the further risks connected with private prosecution are so great as in most cases to outweigh, with those who know what the loss and risk are, the motives of public spirit or revenge, or whatever others they may be that may induce a person to enter on such an undertaking. For in the first place the prosecution must be conducted in the first instance wholly at the prosecutor's own expense, and although in the case of most crimes an allowance is made to the prosecutor by the county in which the trial takes place, this allowance is usually found to bear but a small proportion to the whole expense that the prosecutor necessarily incurs. And in the second place, in the event of the prosecutor not obtaining a verdict, which is very often the case, he is liable to an action of damages for false imprisonment or malicious prosecution, and there is a great chance of his being condemned to pay a considerable sum on this account. In such cases the original prosecutor is indeed entitled to a verdict in his favour if he can show that he instituted proceedings in his prosecution under the reasonable and honest belief that he was accusing the guilty person; but it is a difficult matter to convince a jury of the reasonableness of such a belief when an innocent person has been charged with a crime, or even one who has not been conclusively proved to be guilty. This state of matters has long been regarded as unsatisfactory, but nothing has yet been done to remedy it. The absence of a public prosecutor in England was originally due to the dread which the English entertained of the liberties of the subject being invaded by the crown if such an instrument were placed at its disposal; but now that all reason for such dread is removed, the opinion is gaining ground that the best way to remedy it is to appoint such an officer as exists in Scotland. For information with regard to the procedure in criminal prosecutions see the articles ADVOCATE OF THE CROWN, JURY, PLEADING; and with special reference to Scotland, PRECOGNITION and PROCURATOR-FISCAL.

PROSELYTE (Greek, a stranger or new-comer), in religion, he who leaves one religion for the profession of another; in general, he who changes his religious party or any other party. The Jews had two classes of proselytes, namely, the 'proselytes of the gate,' as they were termed; and the 'proselytes of righteousness,' or of the covenant. Such at least is the distinction made by the Talmudic rabbis, most fully by Maimonides; but modern scholars entertain doubts as to whether this was not rather a theoretical division never made in practice in the precise form in which the rabbis represented it to have existed. It is, however, admitted that in New Testament times at any rate there were proselytes of two degrees, although it cannot be accurately determined how they were distinguished. According to the rabbis the proselytes of the gate were those who renounced idolatry and worshipped the only true God according to the (so-called) seven laws of the children of Noah, without subjecting themselves to circumcision and the other commands of the Mosaic law. They were only admitted to the court of the temple, and stood at the door of the inner temple, whence their name. They had the right of dwelling in the land of Israel, but only in suburbs and villages. The proselytes of righteousness were persons who had been fully converted from paganism to Judaism, had been circumcised, and bound themselves to observe the Mosaic law. Before their circumcision they were examined respecting the grounds of their conversion; after their circumcision they received baptism, being immersed with their whole body in a cistern full of water, on a festival, in the presence of three judges. This baptism, known under the name of *proselyte baptism*, was repeated in the case of those children of a proselyte who had a heathen mother. Boys under twelve and girls under thirteen could not become proselytes without the consent of their parents, or, in case of their refusal, the aid of the magistrates. By the baptism every one was considered as born anew, so that his parents were no longer regarded as such, and slaves thus baptized were set free. Respecting the antiquity of Jewish proselyte baptism there has been much controversy. The rabbis taught that the proselytes of righteousness received from heaven a new soul and a new essential form. The Mosaic laws, moreover, excluded some persons from the privileges of proselytes, sometimes for ever, sometimes for a certain period (Deut. xxiii. 1–5).

PROSERPINE, the Latin name of Persephonē. See PERSEPHONĒ.

PROSODY (Greek, *prosōdia*), the part of grammar that treats of quantity, accent, and the laws of versification. See RHYME, RHYTHM, and VERSE.

PROSOPOPŒIA. See PERSONIFICATION.

PROSSNITZ, a town in Austria, Moravia, in the circle of and 11 miles S.S.W. of the town of Olmütz, on the Rumza. It has three churches, an hospital, and monastery of the brothers of charity; extensive manufactures of woollen and linen cloth, cassimere and cotton goods, in all of which it carries on an important trade; numerous distilleries of brandy and rosolio, and one of the largest corn-markets in Moravia. Pop. (1880), 18,417.

PROSTYLE, a term used in architecture, defined by Gwilt as 'a portico in which the columns stand in advance of the building to which they belong.' The term *amphi-prostyle* is used when there is such a portico attached to a building both in front and behind.

PROTAGORAS, a Grecian philosopher, born at Abdera, in Thrace, apparently about 480 B.C. He was the first to assume the title of Sophist, and to teach for pay, a practice which Plato informs proved very remunerative to him. He taught principally at Athens. When, about 445, a number of Athenians left the city to join in founding the new colony of Thurium, Protagoras drew up a constitution for the Thurians, and he is conjectured by some to have accompanied the colonists. At any rate he was absent from Athens for a number of years subsequent to this. During part of his absence he dwelt in Sicily, where he acquired great fame. He returned to Athens before 430 B.C. In 411 B.C. he was accused of atheism, for beginning one of his works (Peri Theōn —Concerning the Gods) with the words, 'Respecting the gods, I am unable to know whether they exist or do not exist.' For this he is said by some to have been banished; others only mention that the work in which the statement occurs was publicly burned. He seems to have died soon after, perhaps in the same year. He was the author of a large number of works, all of which are lost. The two most important of them were the one already mentioned, and another entitled Truth (Alētheia). One of the dialogues of Plato bears the title Protagoras, and

from it interesting information is derived regarding his mode of teaching.

PROTECTION, in political economy, a method of encouraging industries in a country, by imposing on the products of these industries from other countries, when imported, a tax sufficient to protect the home producers against the competition of foreign ones. This practice is generally condemned by English political economists as enriching a comparatively small number of producers at the expense of the great mass of consumers, who, on account of the protection, have to pay more for the protected articles they want than they would otherwise have to do, and as encouraging certain industries only by withdrawing the people from others for which the country is better adapted by nature. See FREE-TRADE.

PROTECTOR, a title conferred on several occasions in the history of England on those appointed to act as regents, generally during the minority of the king. Those on whom it was conferred were the Earl of Pembroke, in 1216, during the minority of Henry III.; Humphry, duke of Gloucester (1422–47), during the minority of Henry VI.; Richard, duke of York, Feb. 1454 to Feb. 1455, and Nov. 1455 to Feb. 1456; Richard, duke of Gloucester, in 1483, before the death of the young princes his nephews, and his own accession to the throne; and the Duke of Somerset (Jan. 1547 to Oct. 1548), during the minority of Edward VI. On the 12th of December, 1653, the title of lord-protector was bestowed upon Cromwell, as head of the Commonwealth of England, by the council, composed mainly of his principal officers, which then held the chief power. Before his death he appointed his son Richard his successor, but he resigned the title and office a year after (April 22, 1659).

PROTEIDS, a name applied to a group of substances which form the chief part of the nitrogenous material of plants and animals. The proteids as a class very easily undergo change; they are not crystallizable, and hence it is very difficult to obtain them in a pure condition. Proteids contain the elements carbon, hydrogen, oxygen, sulphur, and nitrogen, and very generally phosphorus. The sulphur exists in an unoxidized state, the phosphorus probably as a phosphate. The proteids have been divided by Hoppe-Seyler into the following classes:—

(1.) *Albumins.* Soluble in water. Under this class are included egg-albumin and serum-albumin.

(2.) *Globulins.* Insoluble in water; soluble in very dilute acids and alkalies, also in dilute solutions of sodium chloride and other salts. In this class are included myosin, a substance prepared from fresh muscle; globulin, prepared from fresh blood-serum; fibrinogen, a substance which closely resembles globulin; and vitellin, which is prepared from the yolk of hens' eggs.

(3.) *Derived Albumins.* Insoluble in water and in sodium chloride solution, but dissolved by dilute acids and alkalies. This class includes the two substances acid-albumin, obtained by adding a small quantity of dilute hydrochloric or acetic acid to egg-albumin, heating the liquid to 70°, and neutralizing the liquid; and alkali-albumin, prepared by treating egg-albumin with alkali, heating, and neutralizing with acid.

(4.) *Fibrin.* Insoluble in water; with difficulty soluble in dilute acids and in alkalies, and in neutral saline solutions. Fibrin may be prepared by stirring fresh blood with a twig; it has a filamentous structure, and is very elastic.

(5.) *Coagulated Proteid.* Prepared by heating egg or serum albumin; it is insoluble in water, dilute acids, alkalies, and neutral saline solutions.

(6.) *Amyloid.* This substance resembles coagulated albumin in its insolubility, but differs from it in completely resisting the action of gastric juice. It is deposited in the liver in certain diseases.

(7.) *Peptones.* These substances, into which the other proteids are converted by the action of the gastric juice or pancreatic fluid, are characterized by their extreme solubility and ready diffusibility. See the article PEPTONES.

In the process of digestion it is probable that undigested proteids are converted into peptones; but as yet we possess no very definite knowledge concerning the mutual relations of the various proteid bodies.

PROTESILAUS, one of the Grecian heroes at Troy, was the son of Iphiclus, king of Phylace, in Thessaly, and of Astyoche. He is said not to have originally borne that name, but to have received it because he was the first of the Greeks who leaped ashore on their landing before Troy. It is said that he was immediately killed by a Trojan warrior, according to some by Hector. When his death became known to his wife, Laodamia, she is said to have begged the gods to allow her to converse with him once more for only three hours. They granted her request; and when at the end of the allotted time Protesilaus died for the second time, Laodamia died with him. This forms the subject of one of Wordsworth's finest poems. His tomb was near Elæus, on the Thracian Chersonese. He was honoured as a hero after his death. A temple was erected to him at his tomb, and funeral games were held in his honour at Phylace.

PROTEST, a solemn declaration of opinion, commonly against some act, particularly a formal and solemn declaration, in writing, of dissent from the proceedings of a legislative body, as a protest of the lords in Parliament, or a like declaration of dissent by a minority of any body against the proceedings of the majority. In commerce, a formal declaration, made by a notary public, under hand and seal, at the request of the payee or holder of a bill of exchange, for non-acceptance or non-payment of the same, protesting against the drawer and others concerned for the exchange, charges, damages, and interest. This protest is written on a copy of the bill of exchange, and notice is given to the drawer and endorsers of the same, by which they become liable to pay the amount of the bill, with charges, damages, and interest. (See BILL OF EXCHANGE.) A protest is also a writing, attested before a notary public, a justice of the peace, or a consul in foreign parts, drawn by a master of a vessel, stating the severity of a voyage by which the ship has suffered, and showing that the damage was not owing to the neglect or misconduct of the master.

PROTESTANTISM, in the Christian Church, a general name for the doctrines which arose in opposition to Roman Catholicism. This name, like many others in history, owes its origin to a circumstance comparatively insignificant. It originated in Germany, when those members of the empire who were attached to the Reformation protested (April 19, 1529), before the assembled princes, against the following resolve of the diet at Spires: 'That, until a general council should be held, further innovations in ecclesiastical affairs should be avoided; the mass should not be any further abolished, nor its celebration be prevented in those places whither the new doctrine had already spread; no inflammatory sermons should be preached; and no vituperative writings be printed.' The protesting members were the electors John of Saxony and George of Brandenburg, Princes Ernest and Francis of Brunswick-Lüneburg, Philip, landgrave of Hesse, and Wolfgang, prince of Anhalt, together with fourteen imperial cities, the chief of which were Strasburg, Nürnberg, Ulm, and Constance. In

consequence of this protestation they were called *Protestants*, and soon adopted this name themselves. The word Protestant was afterwards adopted also in other countries. In 1817, on the occasion of the tercentennial celebration of the beginning of the German reformation, the Prussian government prohibited (June 30, 1817) the further use of the term Protestant in the country, as being obsolete and unmeaning, since the Protestants did not any longer protest, and ordered the word *evangelical* to be substituted for it. The numberless sects which have sprung up among the seceders from Catholicism since the time of the Reformation, and which are comprehended under the name of Protestants, all agree (however different their opinions on some important points may be) in rejecting human authority in matters of religion, taking the Holy Scripture as the sole rule of their faith and life, and adhering to particular creeds only as expressing the convictions in which all their members agree. Even when they differ they are often distinguished from each other rather by faint shades than by bold lines of demarcation. See REFORMATION.

PROTEUS, according to the old Grecian mythology, a deified mortal, a soothsaying and wonder-working old man of the sea, who fed the flocks (seals) of Poseidōn (Neptune) in the Ægean Sea, and was said by wandering mariners to sun himself with his sea-calves, and to sleep at mid-day, sometimes on the desert island of Pharos, near the western mouth of the Nile, and sometimes on the opposite side of the Mediterranean, in Carpathus (the modern Scarpanto), between Crete and Rhodes. He prophesied only when compelled by force and art. He tried every means to elude those who consulted him, and changed himself, after the manner of the sea gods, into every shape, into beasts, trees, and even into fire and water. But whoever boldly held him fast to such a one he revealed whatever he wished to know, whether past, present, or future. Thus Menelaus surprised him (Odyssey, iv. 351), and compelled him to aid him by his prophecies and his counsel. Homer calls Proteus Egyptian, either in the literal sense or to signify that he lived in the neighbourhood of the river Egyptus. Later writers represented Proteus as a king in the time of the Trojan war, who, either by divine skill or by an artful change of the ornaments of his head, could assume various forms. According to other accounts, which, perhaps, Virgil had in view, Proteus was a deified sorcerer of Pallene, a peninsula of Emathia or Macedonia. Disturbed by the profligacy of his sons, he went, in the time of Heracles, under the sea to Egypt, and in that unfrequented part of the sea kept the sea-calves of his master Poseidōn, who had given him the wonderful power of prophesying. The later mystics made him an emblem of primeval matter, and he is thus represented in the twenty-fourth Orphic hymn. This mortal-born sea-god now became a son of Poseidōn and Phœnice, or of old Oceanus himself and Tethys. Psamathe was his wife, by whom he had many sons and daughters, whose names are differently given. Any one who hastily changes his principles is, from this old sea-god, called a *Proteus*.

PROTEUS, a remarkable genus of Amphibian Vertebrates allied to the Axolotls, Sirens, &c., and included in the order of Urodela or 'Tailed Amphibia. The Proteus further belongs to the section Amphipneusta or Perennibranchiata (which see) of that order, in which the gills, possessed by all Amphibia in early life, are retained throughout the entire lifetime of the animals, in addition to the lungs with which they are also latterly provided. The Proteus, therefore, represents one of the typical Amphibia, and breathes by both gills and lungs throughout its adult existence. These animals are confined to a very limited portion of the earth's surface, being found only in the waters of certain subterranean caves in Central and Southern Europe—as, for example, in the caves of Central Austria, Illyria, and Dalmatia. The animal itself is about 12 inches long. Its body is elongated, slender, and somewhat cylindrical, and averages about 1 inch or $\frac{3}{4}$ of an inch in diameter. It is of a pale flesh tint—the absence of colour being the necessary result of its non-exposure to light. The tail is broad and compressed. The limbs are of very weak construction, the front legs possessing three, and the hinder limbs only two toes. Three pairs of bright red or scarlet branchiæ or gills project from the branchial clefts on each side of the neck, the bright colour of these external gills contrasting strongly with the otherwise colourless body. Two series of small teeth exist in the upper and in the lower jaw. The eyes are of rudimentary nature, and being completely covered by the skin are not functionally useful. The Proteus is eminently aquatic in its habits, and there is little doubt that the external gills constitute the chief agents in respiration, the elongated lungs with which it is provided being of very rudimentary structure. It swims easily; and in dry seasons, or when the water of the caves becomes dried up, the Proteus is said to bury itself in the mud, after the fashion of the African and American Lepidosirens or Mud-fishes (see DIPNOI); and in the latter case the breathing would become aerial, and be carried on by the lungs.

The single fully-defined species above described is the *Proteus* or *Hypochthon anguinus* (Pl. XV.–XVI. fig. 18); but a few presumed varieties of this species have been also noted. Occasionally one of these varieties has been described as a distinct species under the designation of *Proteus xanthostictus*. The skin in all is smooth, and not invested by scales or hard structures. The caves of Adelsberg in the Duchy of Carniola are among the best-known haunts of this singular form. The red blood corpuscles of the Proteus, it may lastly be noted, are the largest of any known Vertebrate animal, just as those of the Musk-deer (which see) are the smallest. They are oval in shape, nucleated, and measure each about $\frac{1}{400}$th of an inch in diameter. The red blood corpuscles of man average $\frac{1}{3200}$th of an inch, those of the massive Elephant $\frac{1}{2740}$th, and those of the Whale $\frac{1}{3000}$th of an inch in diameter. It will be readily seen from these measurements how greatly the blood corpuscles of the Proteus surpass those of the larger animals in size.

PROTOCOL (from the Greek *prōtos*, first, and *kolla*, glue), originally, in legal instruments, the first sheet glued to the *scapus* or cylinder round which the instruments were rolled. On it were stated the date at which the instrument was drawn up, the names of the persons who drew it up, and a number of other particulars, which served to identify the document. The word has since acquired a variety of other significations, the origin of which it is not in all cases easy to discover. In the language of diplomacy it signifies sometimes the rough draught or the original copy of any instrument, and sometimes the minutes of the deliberations and proceedings of a congress, diet, or conference. In France the term is applied to a book containing the prescribed formulas for instruments accompanying certain transactions, and also to the formulary prescribing the manner in which sovereigns, princes, and heads of departments should address those to whom they write. In Scotland a book was formerly kept under the name of protocol by every notary, for the insertion of copies of all the instruments he might have occasion to draw up. These protocols were intended to serve as records of sasines, and when they were regularly kept were allowed to supply the place of lost documents; but they seldom were so kept.

PROTOGENES, a Greek painter, contemporary with Apelles, born at Caunus in Caria. He flourished between 332 and 300 B.C. Several masterpieces of his are mentioned, particularly a picture of Ialysus, a mythical hero, said to have been the founder of the city of that name in the Island of Rhodes. In this picture a hound was represented panting, and with froth on his mouth. Pliny relates that for a long time the painter was unable to satisfy himself in the execution of the froth; but that at last, in a fit of anger, he threw the sponge with which he used to wipe off the colours on the painting, and thus accidentally produced a natural representation of it. This picture saved the city of Rhodes when it was besieged by Demetrius Poliorcetes, who refrained from making his attack on the weakest part of the city because the picture was placed there, and he feared to injure it. During the siege Protogenes, who lived outside the walls of the town in the midst of the besiegers, is said to have been specially cared for by Demetrius, who frequently visited him and attentively watched the progress of his works, which the painter continued undisturbed amid all the din of the siege. Protogenes is said to have lived in comparative obscurity at Rhodes till the fiftieth year of his age, when his merits were made known to his fellow-citizens through a visit of the equally or even more distinguished painter Apelles. The manner in which the two great artists introduced themselves to one another forms the subject of a celebrated story, which will be found in our article on APELLES. The means which Apelles took to let the Rhodians understand how great a painter they had amongst them was to offer Protogenes the enormous sum of 50 talents for each of his works, which the painter himself had been in the habit of selling for very insignificant sums. The Rhodians thus enlightened, it is said, now wished to buy back the pictures from Apelles, in order that they might keep them among themselves, and Apelles refused to part with them except on getting an advance on the price that he had himself paid. It was probably after this visit of Apelles to Rhodes that Protogenes went to Athens, where he executed one of his finest pictures in the Propylæa. In the time of Cicero it was still in that city, but Cassius carried it to Rome, and placed it in the Temple of Peace, in which it was burned during the reign of Commodus. Quintilian records that Protogenes was remarkable above all painters of the best period for the careful finish of his pictures.

PROTOPLASM (*protōs*, first or primitive; *plasso*, I mould), the name applied to the elementary or primitive organic compound of albuminous nature, which enters into the composition of organized tissues of all kinds. The term is more specially used to denote the substance — indistinguishable from the primitive base of the tissues in higher forms — of which the bodies of the lowest animals or *Protozoa* (which see) and the lower plants or *Protophyta* are wholly composed. The body of an Amœba, the living portion of the Foraminiferous animalcule, or the organism constituting one of the low Confervoid plants, thus consists simply of a microscopic particle of an albuminous jelly-like matter. This matter is known as *protoplasm*, and the names *sarcode* and *bioplasm* have also been applied to it, and have been, therefore, used synonymously with the first-mentioned term. It is to be clearly noted, that no appreciable difference either of chemical or microscopical kind is to be perceived between the protoplasm of the lower forms of life and that out of which the tissues of the highest animals are elaborated, and of which in their primitive or embryonic state they were entirely composed. This protoplasm, therefore, enters into the intimate composition and formation of animal and plant tissues of every kind. It forms the indispensable medium, as it were, and at first sight, for the presence and manifestation of vitality. The tissues of the highest plant or animal form may be considered simply as consisting of elaborated protoplasm, equally as the body of the lower animalcule or plant consists of that substance in a more primitive and undifferentiated state. The difference, in short, between the protoplasm of different organisms is not one of kind, but merely one of the degree to which, through processes of development, it has become elaborated and organized.

The recognition of this universality of a protoplasmic basis or stratum in living organisms founded a most important era in biological science. And hence the term 'physical basis of life,' sometimes applied to this substance, has arisen from a conception that protoplasm, in some more intimate manner than might be generally conceived, is related to the mysterious assemblage of actions and processes to which the terms *living* or *vital* are applied. As we shall hereafter notice, however, the relations of protoplasm to vital or living force are susceptible of different and more feasible explanation than is involved in the above idea, which formed the germ of a theory of vital action attaining a high celebrity of late years.

In its chemical composition protoplasm exhibits carbon, hydrogen, oxygen, and nitrogen united to form one of a group of proximate compounds to which Mulder gave the name of 'proteine' compounds. These compounds, it must be remembered, are essentially of an *albuminous* nature, and the chemical composition of the varied forms of this protoplasmic material is wonderfully constant, although the results of its organization and development may, as already stated, vary in the greatest degree. The other constant physical conditions or characters exhibited by protoplasm may be summed up by stating that this substance undergoes contraction when electric currents are sent through it; and further, that at a temperature of from 40° to 50° (Centigrade; 104° to 122° Fahr.) it coagulates or undergoes the changes implied under the term 'heat-stiffening.'

That protoplasm, however much in mere chemical characters it may resemble other forms of albumen, differs widely from these substances in its relations to life and vitality, cannot be questioned. It thus differs from mere albumen, not only in its power of exhibiting contractility, and in its possessing the power of independent growth, but also, and more strongly, in the fact that of itself (as seen in many animalcules) a minute fragment of protoplasm may constitute a complete living being. And such a minute organism, destitute of all definite or appreciable organization, may live, nourish itself, reproduce itself, and, in short, perform all the functions of vitality as perfectly, so far as its own immediate life is concerned, as the highest animal or plant.

The next point that naturally presents itself for determination is as to the relations in which this protoplasm stands to life and vital force, or in which it becomes so marvellously associated with vital properties. A view, enunciated by Huxley, and supported by many eminent biologists, assumed that life was a property of this protoplasm or sarcode substance. They held that as it was unquestionably proved that life was invariably found to be associated with protoplasm it might reasonably be concluded that life or vitality resulted from the combination of the chemical elements of the protoplasm and in virtue of any other physical or physico-chemical conditions which resulted from that combination. Such a theory may therefore be termed a purely *physical* theory of life, in opposition to a second

hypothesis, which receives the name of the theory of a *vital force*. This second theory or view maintains that, admitting the universality of a protoplasmic basis for living beings, it is nevertheless more philosophical to conclude that, firstly, life is not a mere property of protoplasm; that, secondly, as it cannot be determined whether vitality or the formation of protoplasm precede each other in point of time, it is more reasonable to conclude that life precedes its sarcodic basis, and may therefore as justly be assumed to be the actual *cause* of protoplasm formation; and that, thirdly, since neither chemical nor physical science has been able to demonstrate the nature of or to produce any approach to the living or vital forces characteristic of living beings, such forces cannot be assumed to be of physical origin or to depend for their inauguration or maintenance on purely physical conditions.

These opposing theories are to a certain extent still prevalent and in existence in modern biology, the question of the evolution of living beings possessing an intimate relation to the evolution of life itself, having therefore served to stimulate the progress of the first-mentioned or physical hypothesis. The argument which has been used in support of this physical theory has been illustrated by such metaphors as the following. Water, it is argued, consists of two gases, hydrogen and oxygen. If these gases be therefore combined in certain proportions they form water, and all the properties of water, exhibited under its fluid, gaseous, or solid states, are simply said to 'result from the properties of the component parts of the water.' It is hence urged that as we do not assume that a something called 'aquosity' entered into and took possession of the water, and directed the exhibition of its properties, so neither are we entitled to assume that a something termed 'life,' 'vital force,' or 'vitality' is inherent in and directs the operations of living beings.

This argument, however, is not susceptible of strict practical or even logical application to the merits of the opposing theories. The comparison of the production of water by bringing oxygen and hydrogen together, and the production of vitality by the union of protoplasmic elements, is not a strict parallelism, if it may indeed be deemed a parallelism at all. The elements of water combine with one another in virtue of the ascertained laws of chemical affinity, and we require no new force (or aquosity) to account either for the formation of water or for the exhibition of its properties. In the case of protoplasm we have invariably to assume the existence of some additional force or property which mere chemical or physical laws and conditions can neither produce nor explain. A protoplasmic compound might be artificially manufactured in the laboratory of the chemist by forcing its elements together, but would such a compound exhibit the phenomena and actions characteristic of the humblest piece of *living* protoplasm? The reply is an obvious negative; and it is exactly this superadded something which the vitalist terms life or vital force that defines the dead from the living protoplasm. We require, in short, the existence and operation of new and independent conditions and forces to make the protoplasm *live* in the sense that even the lowest organism lives, since the highest art of the chemist can never attain to the manufacture of *living* protoplasm. And if the forces or conditions, in virtue of which protoplasm lives, are inexplicable by, and without the boundary of chemical or physical science, then it is illogical either to deny their existence or to refuse to assign to them any recognition or place or name in the category of operating influences in the living organism. 'Vitality' has thus a definite status; the 'aquosity' of the physical theorist has no status at all.

Life is thus to be viewed certainly not as a mere quality or property of protoplasm but as an independent principle investing the sarcode matter with all the wondrous actions which we know living matter to possess. Modern science may indeed be unable yet to determine the relations of this living principle or vital force, and this inability to explain these relations has been put forward by the physicists as a point against the logical nature of the theory of vital force. But it is not too much to say that the exact nature of life may remain to us as much a mystery in all future time as it has been from the far back past; and it must not be forgotten that science is by no means always equal to the full discovery of new fields of thought or even to the due appreciation of such as have been discovered. Electricity and magnetism have been comparatively recently studied, but the full appreciation of these forces has yet to be attained. Because, therefore, we are unable to reduce the relations of vital force to mathematical accuracy, and because we cannot even primarily determine these relations, we are not on that account entitled to assume the non-existence of the force. And hence the question at present stands as involving speculations and researches not only of the deepest kind, but such as lead us from the known and finite into the domain of the infinite and unknowable.

What *life* really is we therefore in the present state of our knowledge cannot tell, and we may never be equal to the task of the full and perfect elucidation of the intimate causes and conditions of vital action; but enough will already have been said to show that the causes of vital action are not purely physical, and that its conditions are not susceptible of explanation according to ordinary chemico-physical or mathematical laws. Protoplasm thus viewed becomes the inseparable and invariable *medium* for the exhibition of vitality. In no sense can we assume that medium to represent vitality itself. See also ORGANIZATION, PROTOZOA, &c.

PROTORNIS, a genus of fossil birds, represented by a single species, the *Protornis Glarisiensis*, found in the Eocene schists of Glaris in Switzerland. This bird is the oldest fossil representative of the order of Insessores (which see) or Perching Birds. It appears to have most nearly resembled existing Larks in size and structure. The *Halcyornis toliapicus* of the London clay (Lower Eocene) of Sheppey is another early fossil form of the Insessores, this latter bird being most nearly allied to the Kingfishers.

PROTOZOA (Greek, *protōs*, first; *zōon*, an animal), the name applied to the lowest sub-kingdom or primary division of the animal world. This group is represented by such forms as the Infusorial Animalcules, Sponges, Foraminifera, and allied organisms, &c. Within the limits of this division a great number of organisms were formerly included, which the improvement of biological science, and especially the advance of microscopical research, showed were not entitled to be structurally classified with the Protozoa. As the group at present stands, however, it still includes several forms or even limited groups of organisms, concerning the exact nature of which naturalists are by no means agreed. This latter fact is to be viewed simply as the result of the great difficulty experienced in definitely deciding the exact animal or plant nature of many organisms. And seeing that it is in the lower confines of the animal and plant worlds that the two great kingdoms of living nature merge insensibly into one another; and further, that biological science is as yet unequal to the task of definitely separating animals from plants, it is not surprising that many of the Protozoa and Protophyta are regarded as belonging to a neutral ground, rather than as finding a definite place in

either the animal or the plant world. Indeed, so hopeless and confusing has the task of separating the lower animals from the lower plants been considered, that Professor Hæckel has proposed to constitute a third kingdom or division, intermediate in nature between the animal and plant worlds, and into which all organisms concerning the position or nature of which any doubt could be entertained might be temporarily deposited or classified. For such an intermediate division, partaking of the nature of 'a biological No Man's Land,' as Huxley terms it, the name of *Regnum Protisticum* was proposed. But the scheme has not met with the approval of naturalists generally, since the further task of separating out and arranging the denizens of this intermediate kingdom would form a labour of greater difficulty than that included in the trying to assign organisms at once and simply to either animal or plant world. The difficulty, in other words, at first single, is simply doubled by the adoption of Hæckel's plan.

Bearing these considerations in mind, as absolutely necessary to the clear understanding of the limits of the sub-kingdom Protozoa, the characters or chief characteristics of the group may firstly be enumerated. No definite or positive characters can be given of this sub-kingdom. We rather distinguish its included members by their negative features, that is, by their want of the definite characters which other sub-kingdoms possess. The first character may therefore be stated to consist in the entire *absence of a nervous system* and *of organs of sense*. No perfect *digestive system* is specialized or differentiated. *No symmetry* or definite plan of body-structure can be ascertained to exist in Protozoa, and there is thus an utter want of the elementary or segmental parts to be discerned in other animal forms. No body-cavity or internal space exists. The bodies of Protozoa are composed of an albuminous substance, termed *sarcode* or *protoplasm* (see PROTOPLASM), this matter existing in this group of animals in its simplest and most primitive condition. In the bodies of most Protozoa a minute solid particle termed the *nucleus* (see NUCLEUS) may be discerned, and the nucleus may in its turn frequently contain a smaller particle known as the *nucleolus*. The functions of the nucleus and nucleolus have been considered to be closely related with certain forms of the reproductive processes in these forms. *Reproduction* takes place generally by asexual methods, such as *fission* or simple division of the body-substance, and by *gemmation* or budding; but in some cases (for example, Gregarinida) phenomena closely imitating those seen in the sexual reproduction and ovular development of higher forms have been observed.

The Protozoa are, with very few exceptions, *aquatic* in their habits, and occur in both fresh and salt waters; the Gregarinida, &c., although parasitic at one stage, being aquatic in other stages of their existence. They are usually of minute and microscopic size, the Sponges and a few other organisms presenting the most familiar exceptions to this rule.

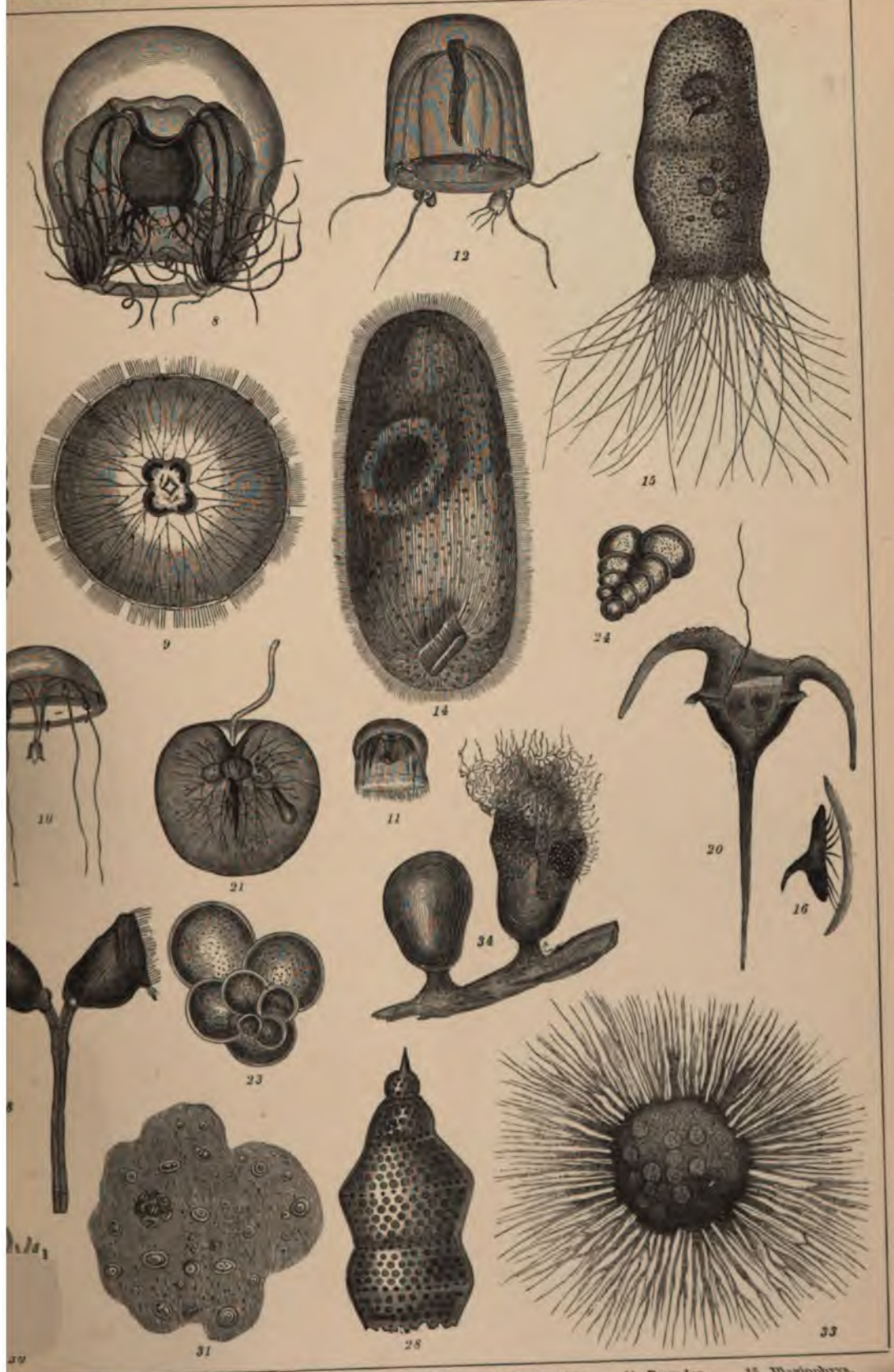
The nature of the protoplasmic substance, of which the bodies of the Protozoa are composed, has already been considered in the article on PROTOPLASM. Nothing more need therefore be said of this substance, or of its relations to the living or vital force, save to remark that it forms a typical albuminous compound, generally semi-fluid in its nature; and consists of an albuminous basis, containing oil-globules and minute solid particles or *granules*, in addition to the better-defined *nucleus*. It possesses inherent powers of growth and contractility, and may evince of itself all the functions and characteristics associated with the possession of life, and the maintenance of the vital state. Many of the Protozoa are nothing more than mere minute specks of this protoplasm, which may thus constitute without further elaboration a true and perfect living being of lowly kind. It is probable, as stated in the article on PROTOPLASM, that this substance acts as a universal medium or basis for the exhibition of that peculiar force or condition, not explicable according to chemical or physical laws, and to which we give the name of *vital force* or *life*.

The Protozoa move about in various ways. Locomotion may thus be performed by simple contractions of the protoplasmic bodies, or by the extension from these bodies of prolongations of the sarcode substance (seen in *Amœba*, &c.), known as *pseudopodia*. In other cases, such as in Infusoria, movements are executed by means of minute vibratile filaments, which, from their resemblance to miniature eyelashes, have been termed *cilia*. These cilia occur in very many other groups of the animal world, and they appear to be endowed with the power of independent motion. They thus move freely with a waving motion, the microscope being unable to determine any structural apparatus or means whereby their movements are executed. Occasionally, as in some Infusoria, the numerous cilia may be replaced by a single large lash-like appendage, known as a *flagellum*, and by means of the movements of this structure the little organisms propel themselves through the water. The currents created by the cilia are frequently used to attract food-particles to the mouth or oral aperture, in addition to the function of locomotion.

The Protozoa may be primarily divided by the absence or presence of a mouth or oral aperture into two main or primary divisions. The first of these includes those Protozoa which are destitute of a distinct mouth, and this group has been accordingly named *Astomata* or *Astomatous* Protozoa. The second primary division, or *Stomata*, includes those in which a distinct aperture for the reception of food exists. Various arrangements of the groups included under these heads will be found detailed in zoological works; one author combining two groups, such as the Rhizopods and Sponges, to form one class, which another authority would decide should be kept as distinct and more definite divisions. And in addition the task of the classifier is rendered the more difficult by the consideration of the place and position, relative to true Protozoan organisms, of those problematical forms, concerning the true nature of which zoological science can afford no definite information. The simplest classification divides the Protozoa into four chief classes. These are the *Gregarinida*, *Rhizopoda*, *Spongida*, and *Infusoria*. The first three of these will fall under the Astomatous division, as not possessing a distinct mouth; the Infusoria or highest class of itself constituting the Stomatous group, as possessing a definite oral aperture.

Class I. *Gregarinida* (Latin, *gregarius*, occurring in numbers). The members of this group, first defined by Dufour, are defined as parasitic Protozoa, destitute of a mouth, and which do not possess the power of emitting *pseudopodia* or processes of the body-substance, as seen in the next class, that of the Rhizopoda. The typical genus *Gregarina* represents this class. The Gregarinæ occur as minute parasites, inhabiting the alimentary canal of certain insects (for example, Cockroach) and other Annulosa, but occurring in Vertebrates also. The body of a typical Gregarina might be described as consisting of a little fusiform or somewhat ovoid mass of protoplasm, bounded by an ill-defined wall or envelope-membrane. The protoplasm is granular in its characters, and usually contains a nucleus and nucleolus. In actual size these organisms vary from that of the head of a small pin to ½ inch in length, or even more. The body-substance may be uniform and undivided

1. Diphyes. *2.* Physalia or Portuguese man-of-war. 3–5. Various views of Velella. *6.* Campanularia. *7.* Hy
16. Aspidiscus. *17.* Stentor. *18.* Zoothamnium. 19. Opalina. 20. Peridinium. *21.* Noctiluca. *22.*
30. Amœba. *31.* Bathybius. *32.* Axinella polypoides. 33. Protomyxa. 34. Trichia.



9. Aurelia. 10. Geryonia. 11. Tiaropsis. 12. Sarsia. 13. Stylonichia. 14. Prorodon. 15. Plagiophrys.
gerina. 24. Textularia. 25. Actinophrys. 26. Carpocanium. 27. Callozoum. 28. Eucyrtidium. 29. Halionema.

in character, or it may present the appearance of being internally divided in various ways; and on these appearances, as will be presently noticed, a classification of the group by Stein has been founded. Occasionally one extremity of the body may be provided with hooked processes, by means of which these organisms can attach themselves to the digestive tract of their hosts. No traces of digestive, circulatory, or nervous centres can be perceived. Nutrition is effected by the simple imbibition of the fluids of their hosts. The Gregarinæ appear to be able to effect certain slow, ill-defined movements of their colourless bodies.

Reproduction takes place after a method which would appear to imitate closely the process of true development, as it occurs in the impregnated eggs of higher animals. Two Gregarinæ may thus be observed to coalesce, or the changes to be described may take place, in some species, in a single and individual Gregarina. And around the two Gregarinæ, or the single Gregarina, as the case may be, a cyst or wall soon develops. The mass then becomes motionless, and of a spherical form. The nucleus and nucleolus next disappear, and the contents or interior of the cyst become divided and subdivided (very much after the fashion of the segmentation of the yolk in the egg of higher animals) until the entire mass within the cyst is broken up into a great number of minute spindle-shaped bodies, to which the name of *pseudonavicellæ* is given. The cyst next ruptures or bursts, and the pseudonavicellæ escape. If they obtain a congenial habitat, such as amongst water, they appear each to develop into little amœboid masses of protoplasm, possessing the power of shooting out their bodies into processes, and otherwise resembling the Rhizopodous organisms hereafter to be described under the name of *Amœbæ*. A few additional changes, mainly devoted to the consolidation of the body, and to the assumption of the mature form, suffices to change each pseudonavicella into a young Gregarina. These gaining admittance, either before or after their pseudonavicular state, to the bodies of their characteristic hosts, repeat the strange reproductive history thus chronicled.

The Gregarinæ thus evince, each in its mature structure, the form and characters of a simple cell, and the developmental process in these forms bears a strong analogy, if not a still more intimate relation, to that of the development of the true impregnated eggs of other animals.

Various species of these animals are known. The *Gregarina* of the Common Earthworm is a familiar species, and *G. sænuridis*, and *G. Sipunculi*, *G. Sieboldii* are also known. *G. gigantea* of the Lobster attains a comparatively large size; and its pseudonavicellæ are exceedingly like Amœbæ, and give off each two detached processes, which move about independently of the pseudonavicella itself. Stein has divided the class Gregarinida into the (*a*) *Monocystideæ*, or those without constrictions or internal partitions or septa; (*b*) *Gregarinariæ*, those with the body divided into two portions; and (*c*) *Didimophydæ*, those with the body divided into three parts, as if one Gregarina from each of the other two sections had coalesced. These organisms have been variously regarded as larval Annuloida, as vegetable forms, and by Hæckel as Amœbæ degenerated for a parasitic life.

Certain peculiar little hemispherical or oval bodies, known as *Psorospermiæ*, found on and within the bodies of fishes, are generally regarded as being most nearly related to the members of the present class, and as being identical with free pseudonavicellæ of Gregarinæ (Lieberkühn). By Balbiani they are regarded rather as plant-organisms. See also PARASITES.

Class II. *Rhizopoda* ('root-footed'). The Rhizopodous Protozoa are defined as those destitute of a mouth, and which possess the power of emitting processes of their body-substance, termed *pseudopodia*. This latter power has gained for them the distinctive term of 'Root-footed' Protozoa. These forms may be either simple or compound. The Amœba (Pl. CLXIII.–CLXIV. fig. 30), an organism common in all our fresh water ponds and ditches, may be selected as a very familiar representative of this class. It exists as a microscopic mass of protoplasm, which, when placed under the microscope, exhibits curious movements of its protoplasmic body. It may thus be seen to push its body out into finger-like processes, or *pseudopodia*, and by means of these to move about, or to grasp particles of food. These processes can be usually protruded from any portion of its body, and are freely pushed out, and as freely withdrawn again into, or merged with the general sarcode-matter of the body. It thus continually evinces alterations of the shape of its body, and from this fact received its former name of *Proteus*-animalcule; this latter term being, however, discarded for its present name of Amœba. Within the body of the Amœba a nucleus and nucleolus are usually to be perceived, and certain clear spaces, termed *contractile vesicles*, may also be noticed. These spaces are so named from their exhibiting rhythmical movements of contraction and dilation, resembling thus the movements of a circulatory organ or heart; and the function of distributing fluid throughout the protoplasmic body has been theoretically assigned to these vesicles, although the actual demonstration of the function has not been attained.

The protoplasm of the Amœba's body exhibits a differentiation into layers; the outer and firmer layer being termed the *ectosarc*, and the inner and more fluid one the *endosarc*. The nucleus and contractile vesicles are contained within the endosarc, the ectosarc mainly giving origin to the pseudopodia. Food seized by means of the pseudopodial processes is engulfed within the soft sarcode body and by any portion of its surface, no distinct mouth being found. The apertures by which food is taken in close up immediately after the intussusception of the nutriment. A clear space forms around each food-particle after it has been received into the sarcode-body, and the particle, if digestible, is slowly dissolved; the clear spaces left for a short time after the digestion of food in this way being termed *food-vacuoles*. It is needless to remark that the temporary food-vacuoles are not to be confounded with the permanent contractile vesicles, which latter form definite parts of the organization of the Amœba. It is doubtful whether or not any definite outer cuticle or membranous envelope surrounds and invests the ectosarc of the Amœba's body. Effete matters and indigestible products are simply ejected from the body by any part of its surface; a temporary vent being thus formed similarly to the temporary mouth. In some cases a certain portion of the body, named the *villous region*, has been said to be more definitely assigned to the function of ejecting effete matters. No traces of a nervous centre or of sensory organs exist, and locomotion is effected by the pseudopodial filaments.

Reproduction may be observed by a simple process of *fission*, whereby an Amœba may simply divide into two portions, each of which becomes a distinct and separate animalcule; or a single pseudopodium may detach itself from the parent-body, and by a process of growth develop into a mature Amœba. A process of generation allied to that described in Gregarina also occurs in Amœba and its allies. The body thus becomes cystiform, and segmentation or division of its internal portion produces little masses

corresponding to pseudonavicellæ, which develop into Amœbæ on their liberation by the rupture of the parent-cyst. It is, however, to be also borne in mind that several other Protozoa, and also higher animals, and even several lower plants, in their development produce Amœboid masses. These masses, however, are simply Amœba-*like*, and have no relation to the true and definite animalcule which has just been described.

Such is a description of a typical member of the class Rhizopoda. The classification of this group is generally arranged so as to include either two or three orders; but authorities such as Schultze and D'Orbigny have greatly extended in number the subdivisions of the group. Schultze classifies the Rhizopods into two chief divisions, with subdivisions as follows:—

A. *Nuda* or Naked Rhizopods. Example, Amœba.

B. *Testacea* or shelled forms. 1. Monothalamia—Single-chambered Foraminifera. 2. Polythalamia—Many-chambered Foraminifera. (*a*) *Helicoidea:* segments of shell arranged in a convolute series. (*b*) *Rhabdoidea:* segments arranged in a straight line. (*c*) *Soroidea:* segments arranged in an irregular manner.

The simpler mode of arranging the class Rhizopoda is to divide it into three or four orders. The first order, *Monera*, is of somewhat provisional and temporary nature, and was proposed by Hæckel as the name of a division including certain low organisms of doubtful nature, the bodies of which are composed of structureless protoplasm, and which possess no nuclei or contractile vesicles. The pseudopodia further exist as delicate interlacing filaments. No shell or test is developed, and the body, although capable of changing its shape, as in Amœba, is mostly circular or spherical in form. Reproduction takes place usually by fission. All Monera are inhabitants of the sea.

The second order, that of the *Amœbea*, includes the genus Amœba and its allies, which are distinguished by their bodies being unprotected by a hard test or shell, or they may be invested by a membranous envelope or *carapace*, which may (as in *Difflugia*) be strengthened by having particles of sand imbedded in it. The pseudopodia in this order are short and blunt, and do not unite with each other. A nucleus and contractile vesicles are present. Of the genus *Amœba* several distinct species have been described. *Amœba radiosa* and *A. princeps* are two familiar forms; and in the sarcode of *A. bilimbosa* of Auerbach starch granules have been discovered. In the genus *Difflugia*, of which *D. proteiformis* may be selected as an example, an oval carapace exists, the pseudopodia being protruded from its upper or terminal aperture, and these forms thus creep about on their pseudopodia bearing the carapace uppermost. In the genus *Arcella* the carapace is hemispherical in shape, and its margin may bear spinous processes. The aperture through which the pseudopodia are emitted in *Arcella* exists on the flat surface of the hemispherical carapace. *Arcella acuminata* is a familiar species of this genus. In *Pamphagus* (Bailey) no carapace exists, but the body-envelope is of firm nature, and allows the pseudopodia to be protruded from one extremity of the body only. This animalcule (*P. mutabilis*) undergoes great changes in form, from its habit of throwing its soft sarcode-body around all objects with which it comes in contact, as if to swallow or engulf them. The genus *Actinophrys* contains the familiar 'Sun Animalcule' (*A. sol*), so named from the radiating manner in which the pseudopodia are given off from the spherical body, which averages $\frac{1}{1500}$th of an inch in diameter. The order Amœbea has thus been divided into two sub-orders—*Amœbina*, including those in which the body is naked, as in *Amœba;* and *Arcellina*, in which (as in *Difflugia*, &c.), the body is contained within a carapace.

The *Foraminifera* form the third order of the class Rhizopoda. In these organisms the body is inclosed within a *calcareous* or *limy* shell or test. The sarcode of the body is not divisible into ectosarc and endosarc, as in Amœbea, and no nuclei or contractile vesicles are present. The pseudopodia are elongated and interlace with each other, and from this latter fact Dr. Carpenter has applied the name *Reticulosa* to the group. These organisms are marine, and are found distributed in all seas, and especially in the oceans of tropical regions. In modern sea-beds these organisms form a thick layer of organic deposit, which tends, as in past ages, to consolidate into a chalk-formation. The term *Foraminifera* is derived from the presence in the shell-walls of minute apertures or *foramina*, through which the pseudopodia are protruded. The sarcode-matter of the bodies of these organisms appears to be of a more primitive kind than in other Protozoa; and it may be red or yellowish in colour. Through the network-like conformation of the pseudopodia a 'cyclosis' or circulation of granules is carried on. The shells—and consequently the *living* portion also of the bodies of Foraminifera—exhibit a division into two groups—the *Monothalamia* or 'single-chambered,' and the *Polythalamia* or 'many-chambered' forms. The many-chambered forms are originally and at first single-chambered, and are produced by a process of budding or gemmation, which, according to its direction, may develop various shapes of shell. By budding in a straight line a shell such as that of *Nodosaria* is produced. And similarly if new segments are added to the shell in a spiral manner, we have produced *nautiloid* or *trochoid* shells; or those of a more irregular form, as in *Globigerina* (fig. 23), or *Textularia* (fig. 24). The various loculi or chambers of a compound shell communicate with each other by apertures; so as to render the sarcode or living matter continuous throughout. In some forms a system of branching tubes has been detected in the walls of the shell, the function of these tubes being supposed to be that of bringing the parts of the shell and sarcode into closer relation. In some forms the shell may simply be arenaceous, or composed of particles of sand united by a membrane, as already seen in *Difflugia*. In others the shell is said to be porcellanous or opaque-white, and not perforated for the pseudopodia, which (as in *Miliola*), are protruded from one extremity only. The vitreous shells are transparent and glassy, and numerous foramina exist in their walls.

As already remarked the Foraminifera are classified in various ways. Dr. Carpenter divides them into the *Imperforata*, in which the shells are membranous or calcareous and imperforate, the pseudopodia being emitted from one extremity only. This group includes the families Gromida (with membranous shells), Miliolida (with porcellanous shells), and Lituolida (with arenaceous shells). The *Perforata*, or second group, includes those Foraminifera in which the shell is vitreous, or rarely arenaceous, and perforated for the protrusion of the pseudopodia.

Of *Monothalamous* forms *Lagena*, *Gromia*, *Entosolenia*, &c., may be selected as examples; the *Polythalamia* being represented by *Nodosaria*, *Discorbina* (fig. 22), *Globigerina* (fig. 23), *Textularia* (fig. 24), *Polystomella*, *Nummulites*, &c.

The *Radiolaria* forms the fourth and concluding order of the Rhizopodous class. These organisms possess shells, tests, or spines of siliceous or flinty matter, and their pseudopodia appear as radiating

filaments which sometimes interlace. An ectosarc and endosarc are generally to be distinguished in the sarcode-matter of their bodies. The *Acanthometræ* of J. Müller form the first family or group of this order, the shells of these organisms consisting of a framework of hollow silicious spines, which emit some of the pseudopodia. These forms are all marine, and of microscopic size, being found floating on the surface of the ocean in large numbers. *Acanthometra lanceolata* is a familiar example of this division. They appear to possess no locomotive powers. The second Radiolarian group, that of the *Thalassicollidæ* of Huxley, includes forms which may be simple or compound in structure. They are abundant in most seas, and do not possess great or any power of motion. They are found floating near the surface of the water, and in size vary from 1 inch to much smaller dimensions. The body consists of sarcode, imbedded in which are a number of cellular bodies, each of which consists of an outer membrane containing granular matter and a nucleus. The sarcode matter itself surrounds a large inner cavity or space. No contractile vesicles exist. The shell may consist of a number of delicate spicula, or of a network-like arrangement of silicious spines. *Sphærozoum punctatum* is a familiar form; as also is *Thalassicola nucleata*. In *Collosphæra*, the third typical genus, a transparent, brittle, silicious envelope exists. All the members of this group are marine.

The *Polycystina* are described under the article of that name. They possess beautiful regular shells composed of flint. *Haliomma* (fig. 29) and *Podocyrtis* are typical genera.

Bathybius (fig. 31) is an anomalous form, presumably of Protozoan kind, consisting of a mass of sarcode of undefined form, and having imbedded within this mass little calcareous bodies known as *coccoliths*, which latter are sometimes united to form spherical masses termed *coccospheres*. These coccoliths have long been known as attaching themselves to Foraminiferous shells. Carpenter believes that Bathybius itself is a rudimentary form of a compound Foraminifer. The coccoliths are alleged by Carter to be simply unicellular calcareous Algæ, or sea-weeds of a low type of organization; the coccospheres being the sporangia or spore-cases of these forms. In this view the association of these bodies with Bathybius is regarded as merely of accidental kind or nature.

Class III. *Spongida*. This group includes the sponges, the exact nature of which was for long a puzzle to naturalists, but which by almost universal consent are now included in the animal world. Several authorities, however, still appear to think that these organisms are more nearly allied to the vegetable kingdom, but a review of their life-history clearly shows their truly animal nature. The present class may be defined as including organisms composed of sarcode-bodies or particles not possessing a distinct mouth, and which form compound masses. This mass is generally supported either by a skeleton of horny fibres, or by one of limy or flinty spicula. And the entire organism is perforated by a system of canals opening on the surface. A sponge is therefore to be viewed as a compound organism rather than as a single animal form; and in the nutrition, as well as the development and reproduction of this class many interesting features are to be noted. See SPONGE.

Class IV. *Infusoria*. The members of this class are so named from their occurring in infusions of animal and vegetable matter which have been exposed to the air. They form the highest organisms of the Protozoa. They are defined as possessing a mouth, and a rudimentary digestive cavity. They do not possess the power of emitting pseudopodia; and locomotion is performed by means of *vibratile cilia*. They are all of minute size, and the sarcode-matter of their bodies is divisible into three layers. Illustrations of this class may be found in the plate, figs. 13, 14, 15, 16, 17, 18, 19, 20, 21, &c. The chief features in the morphology of the group may be seen in such a form as the Stentor (fig. 17) or 'Trumpet-Animalcule;' or in Vorticellæ, Zoothamnium (fig. 18), and other stalked forms, &c. The body is composed externally of a transparent skin or pellicle, named the *cuticle* or *cuticular layer*, within which a layer of firm sarcode exists known as the *parenchyma* of the body or *cortical layer*. The third or central layer is soft, and of more fluid consistence, and is named the *chyme-mass* or *abdominal layer*. The cuticle is fringed by vibratile cilia, by means of which locomotion is effected, and currents created in the water for the purpose of drawing food-particles towards the mouth. This latter aperture opens into the cuticle, and is continued into a gullet-like tube, which, however, does not lead into any stomach, but simply merges into the general protoplasm of the central part of the body. The cortical layer contains the nucleus and contractile vesicles. The nucleus is generally elongated, and possesses a nucleolus either attached to its external surface, or imbedded in its substance. The functions of the contractile vesicles are thought (as in *Amœba*) to be those of a circulatory apparatus, and as if in support of this view, tubular canals have been traced passing from these vesicles into the internal parts of the body. Whether or not these vesicles communicate with the external medium, or what is the nature of the fluid circulated by them, are points still undetermined. The food-particles, swept into the mouth, pass down the gullet, and are indiscriminately lodged in the general protoplasm of the body. Around each food particle a clear space or vacuole forms, as in *Amœba*, and the presence of these vacuoles led Ehrenberg to suppose that these animalcules possessed a number of stomachs or digestive sacs—a belief which led him to name this class *Polygastrica*. It has, however, been definitely ascertained that no digestive sacs exist, and that the food vacuoles are merely of temporary duration and nature, and that food may be, and is, digested by any portion of the sarcode-body. Indigestible matters in some cases appear to be expelled by an aperture placed near to the mouth.

The *nucleus* is viewed as corresponding to the ovary or female generative apparatus, and the nucleolus as a *testis* or male organ. Reproduction may be effected by fission or simple division of the body-substance, by gemmation, or budding; or by processes analogous to sexual generation in higher animals. A process of *conjugation* has been observed to occur in some forms (for example, *Paramœcium*), in which transference of the nucleoli takes place between two forms; a development of germs succeeding within the bodies of the conjugating animalcules. These germs being liberated develop into adult Infusoria. In others a process of *encystation* occurs; the animalcules becoming cyst-like (as in *Gregarina* and *Amœba*), and a division of the nucleus or body-contents taking place. The rupture of the cyst-like parents gives origin to the little particles or germs therein produced, and the latter develop in turn into adult animalcules. This process is well seen in the stalked Vorticellæ.

These forms are classified in three orders. In the first of these, named *Ciliata*, and which includes the great bulk of Infusorian forms, the vibratile cilia are disposed more or less plentifully over the outer layer of the body. Some are also provided with jointed bristles or styles, or with little hooked processes termed *uncini*. Of this group the free-

swimming *Paramœcium*, or Slipper-Animalcule; *Bursaria*, *Aspidisca*, the stalked *Vorticellæ*; *Epistylis*; and *Carchesium*; the *Stentor*, sometimes free, sometimes attached; and many others may be cited as examples. It must also be remembered that the number of known species is very great. The *Flagellata*, forming the second order, are distinguished by the possession of elongated lash-like appendages or *flagella*, although cilia may also be developed. Examples of this group are seen in *Peranema* (with one flagellum), in *Anisonema* (with two), and in *Heteromastix* and *Pleuronema* (with both flagella and cilia). The last order, or *Suctoria*, is distinguished by its members possessing radiating tubes provided at their free ends with suctorial discs, and which can be retracted or protruded. The exact nature of these suctorial forms (of which *Acineta* is the type) has not been, as yet, thoroughly determined. Some observers think the Suctorial Infusorians simply represent transitional stages in the development of other members of the class—such as *Vorticellæ*.

Noctiluca miliaris (fig. 21) is probably an Infusorian allied to the Flagellata. It is the cause of the diffuse luminosity or phosphorescence of the sea, and is noticed in the articles NOCTILUCA and PHOSPHORESCENCE.

The nature of the origin and development of Infusoria have long formed subjects of extreme interest to the biologist. As explained in the article GENERATION (SPONTANEOUS) some authorities or *Abiogenesists* believe that these forms may be spontaneously produced from the particles or matter of the organic infusions in which they are found; or, in other words, without the pre-existence of parent organisms, of germs, or of eggs. This belief constitutes the doctrine of *spontaneous generation*; and recent supporters of this theory would seem to maintain that these organisms may appear even in infusions of *inorganic* matter, which have not in any way been exposed to the air. The Biogenesists or Panspermatists, on the contrary, believe that these Infusoria appear in infusions of any kind as the result of the development of their germs or eggs which are borne by the atmosphere in large quantities, gain access to infusions, and therein become developed into adult animalcules. They also maintain that in cases where air is perfectly excluded, these germs may originally have been contained in the infusion, and that heat does not destroy the germs, these being of a low degree of vitality. The question presents very many difficult points, and very many elaborate experiments are still being carried on by both parties. This much is certain, however, that whether or not 'spontaneous generation' be actually proved to occur, there can be no doubt that in ordinary cases these animalcules are produced from germs borne in the air, since the existence of these germs has been duly established, and their development into Infusoria fairly traced.

The *palæontology* of the Protozoa forms a very interesting subject. Only the Foraminifera, Radiolaria, and Spongida are represented as fossils, these groups alone possessing hard structures capable of preservation. The Foraminifera occur in all the fossiliferous rocks from the Laurentian formations to the present day. Of fossil Foraminifera the most famous is the *Eozoön Canadense*, or 'Dawn of Life Animalcule,' which appears to have been a gigantic Foraminifer, occurring in reef-like masses in the Laurentian rocks of Canada. The Nummulites (which see) were also large extinct Foraminifera of the Kainozoic period. The genus *Miliola* is also plentifully represented in a fossil state in the Eocene limestones of the Paris basin. The Lower Silurian formations of Russia contain species of the genera *Rotalia* and *Textularia* (see fig. 24). *Fusulina* occurs in the carboniferous limestones of the Southern Alps, Russia, the United States, &c. The chalk or cretaceous rocks of the Mesozoic period, and particularly the white chalk, well seen in the south-east of England, is largely composed of Foraminiferous remains. The Globigerina (fig. 23) of the existing sea-beds, *Rotalia*, and *Textularia* are all represented in the chalk rocks. The upper greensands of the cretaceous system contain the remains of a gigantic Foraminifer, which possessed an arenaceous shell, and which is named Parkeria.

The Radiolaria, represented by the Polycystina (which see), occur in Mesozoic, but particularly in Tertiary formations, as in the 'infusorial earth' of Barbadoes. The Spongida are doubtfully represented as fossils by *horny* sponges. The *calcareous* or limy sponges first appear in Silurian rocks, and attain their maximum in the Mesozoic formations, whilst they are few in number in the present day. The *silicious* or flinty sponges first appear in the Mesozoic rocks, and were developed in greatest plenty in the chalk system. These latter exist in comparative plenty in the present day. The Infusoria are not known to occur in a fossil state.

In Pl. CLXIII.–CLXIV., containing illustrations of the sub-kingdom Protozoa as mentioned above, there are also several figures of Cœlenterate animals, belonging to the class Hydrozoa, to which a brief reference may in the present instance be made. Fig. 1 represents a form of oceanic Hydrozoa, Diphyes or Praya, belonging to the Hydrozoal order, Calycophoridæ. In this form we find a couple of large mitre-shaped *nectocalyces* or swimming-bells, and an elongated *cœnosarc* or common connecting medium, bearing the little animals or *polypites*. (See POLYPI.) This cœnosarc is highly contractile, through the presence of muscular fibres. Each of the polypites is protected by a delicate glassy membrane known as the *hydrophyllium* or 'bract.' Fig. 2 represents the Physalia or 'Portuguese man-of-war,' described in the article PORTUGUESE MAN-OF-WAR (which see). In figs. 3, 4, and 5 different views of an organism belonging to the order Physophoridæ are given. This organism is known as the *Velella*, and is nearly allied to the Physalia. The body consists of a flattened rhomboidal *pneumatophore* or 'float,' bearing on its upper surface an elevated vertical crest, placed diagonally. A single large polypite is situated on this flattened disc, and is nearly central in position, and reproductive bodies termed *gonoblastidia* or *phyogemmaria* are also attached thereto. No nectocalyces or swimming-bells exist; and numerous tentacles are attached around the margins of the disc. *Velella* averages about 2 inches in length and 1½ inch in height. It is composed of a transparent substance, coloured blue, and floats on the surface of the sea, being driven along by the wind acting on the vertical crest as on a sail.

Fig. 6 represents *Campanularia* (magnified), one of the Hydroid Zoophytes belonging to the order Campanularida, the members of which group are nearly related to the more familiar Sertularida or 'Sea-firs.' The polypites with their tentacles are seen in the figure, and also one of the *gonophores* or reproductive bodies in its attached condition. Fig. 7 represents the Hydra or common Fresh-water Polype (magnified)—the organism which forms the type of the entire class Hydrozoa. This animal, of minute size, inhabits fresh-water pools and ditches, and consists of a tubular body, attached generally to aquatic plants by one extremity, and possessing a mouth surrounded by tentacles at the other. The protuberances seen on the sides of the figure are the reproductive bodies.

Fig. 8 represents *Bougainvillæa*, one of the Gymnophthalmata or Naked-eyed Medusidæ (which see) or jelly-fishes. In this genus, belonging to the Hydro-

zoal order Medusidæ or Discophora, the *umbrella* or nectocalyx is spherical in shape, and the tentacles are arranged in four marginal groups. In fig. 9 *Aurelia*, a common genus of Medusidæ, is represented, as viewed from below. In fig. 10 *Geryonia*, a genus of Medusidæ, is depicted; this form possessing a hemispherical umbrella and an elongated peduncle of inversely conical shape, with four lips. An allied form (*Tiaropsis*) is represented in fig. 11. The genus *Sarsia*, of which *S. gemmifera* is a familiar species, is represented in fig. 12. This genus also possesses an umbrella of hemispherical shape, and four marginal tentacles. The ocelli or eyes also number four, and the peduncle is of simple conformation, cylindrical and extensile. In this genus, and as represented in the figure, Medusa-like zooids may be produced by a process of *gemmation* or budding from the marginal canals, tentacles, or sides of the peduncle.

PROTRACTOR. An instrument for laying down and measuring angles on paper with accuracy and despatch, and by which the use of the line of chords is superseded. It is of various forms—semicircular, rectangular, or circular. The most convenient kind of protractor is perhaps that in the form of a circular disk of translucent horn.

PROUDHON, Pierre Joseph, a French publicist, born at Besançon, January 15, 1809; died there January 19, 1865. He was the son of poor parents, who were unable to pay for his education, but by the influence of some persons who had remarked the boy's abilities, he was enabled to attend gratuitously the college of his native town. Before completing his course he was obliged to seek some means of earning his bread, and he entered a printer's office in Besançon, where he ultimately became a compositor. In this quality he made the round of France, and rose to the post of reader. Both as compositor and as reader he took full advantage of the opportunities he had of increasing his knowledge, and supplemented by private studies the fragmentary information that came in his way in the ordinary course of his occupation. In this way he made considerable linguistic acquirements, and his first publication was a philological treatise entitled Essai de grammaire générale prefixed to an edition of Bergier's Éléments primitifs des langues, which was printed in 1837 by a firm of Besançon, of which Proudhon at that time had some share in the management. In 1838 he had conferred on him by the Academy of Besançon the *pension Suard*, which yielded him an income of 1500 francs for three years, and thus furnished him with the means of continuing his studies and literary labours. In 1839 he published a Discours sur la célébration du dimanche, together with a new version of his former essay. Political economy now became his chief study, and in 1840 appeared his famous work, bearing on the title-page the question: Qu'est-ce que la propriété? (What is property?), to which the first page of the treatise contains the answer, 'C'est le vol' (it is theft). The principal theses there maintained by him are that labour is the sole just ground of individual possession, and that all labour ought to be rewarded equally. This first treatise was followed in 1841 and 1842 by two pamphlets in the same strain. The second of these, entitled Avertissement aux propriétaires, was written in a more aggressive and menacing style than any of his previous publications. The public prosecutors at Besançon deemed it necessary to take the matter up, and he was summoned to appear before them and answer to the charges of making an attack upon property, inciting to hatred against the government and several sections of the people, and of committing offences against religion. He has himself given an amusing and dramatic account of the proceedings in connection with this trial, of the horror which his name and presence inspired among all classes of the people, the surprise excited by his inoffensive appearance and behaviour when he stood up to speak for himself, and the mystification which he caused by his abstruse defence in prosecutors, judges, and the jury, who returned a verdict in this form: 'This man is in a sphere of ideas inaccessible to the vulgar; we cannot condemn him at random; and who will answer for his culpability?' He was accordingly acquitted. In 1843 Proudhon undertook the management of a system of transports on the Rhône and Saône. But he still continued to publish at intervals. In this very year appeared his treatise De la création de l'ordre dans l'humanité, a proposed system of political organization; and in 1846 his Contradictions économiques, in which the proposals of Utopian reformers and the doctrines of English political economists are vigorously combated. After the revolution of February, 1848, he began the publication of a journal at Paris called Le Représentant du peuple, which, however, was speedily suppressed. But he had by this time acquired so much popularity that he was elected the representative of the Seine in the constituent assembly. In the assembly he had little success, and he therefore showed as much assiduity as ever in trying to make known and extend his ideas through the press. He published several pamphlets (Le Droit au travail, Les Malthusiens, Démonstration du socialisme, Idées révolutionnaires), and started three journals in succession, Le Peuple, La Voix du Peuple, and Le Peuple de 1850. In 1849 he began to organize a bank under the name of Banque du Peuple, with the object of abolishing interest, securing the free circulation of bills, and consequently putting an end to capital. This project, however, never came to anything, for the projector, before he could get his arrangements completed, was accused of some offence against the press laws, and condemned to three years' imprisonment. He returned the advances that had been made to him on account of the bank, and then sought to save himself by flight, but he was ultimately captured and detained for the term of his sentence. In the first year of his imprisonment (1849) he married, and in spite of his hostility to the church underwent the religious ceremony on the occasion, and afterwards had all his children baptized. During the course of his imprisonment (which was light) he published various works: Confessions d'un révolutionnaire (1849); Actes de la Révolution (1849); Intérêt et principal (1849); Gratuité du crédit (1850), the last two a resumé of discussions he had had with Bastiat on the subject of interest, he maintaining that there ought to be no such thing; and La Révolution sociale démontrée par le coup d'État (1852). In 1852 he was liberated, and he then entered again into private life. He continued to be a prolific writer, and published during the last years of his life, Manuel du spéculateur à la Bourse (1856); De la justice dans la Révolution et dans l'Église (1858); La Guerre et la paix (1860); Théorie de l'impôt (1861); Les majorats littéraires (1862). Several works of his have also been published posthumously, among them Du principe de l'art (1865); De la capacité politique des classes ouvrières (1865); Théorie de la Propriété (1865). The publication of his correspondence was begun in 1874.

PROUT, Samuel, a distinguished painter in water-colours, was born in Plymouth on 17th September, 1783, and from his earliest childhood manifested a decided turn for drawing, but the only lessons he ever received were a few from a drawing-master in his native town. In 1801 he made the acquaintance of Britton, the celebrated architectural antiquary,

who employed him in visiting the rural districts of England to make sketches, which were engraved in the Beauties of England. The favour with which these drawings were received induced him in 1805 to take up his residence in London. In 1818 he visited the Continent for the first time, and frequently again returned thither, the result of these excursions being a vast store of beautiful water-colour drawings, which placed him at the head of this department of art. They consist more especially of the monuments of mediæval architecture throughout France, Germany, and Italy. Prout also directed his attention to lithography, and published several admirable collections of lithographed sketches. He is likewise the author of Hints on Light and Shadow and the Young Student's Drawing Book, books of instruction in art. Shortly after the ascension of Queen Victoria he was appointed 'painter in water-colours to the queen,' and a few years afterwards received a similar appointment from Prince Albert. Throughout life his bodily health was extremely delicate, but he possessed great buoyancy of spirits, and was in every way a most amiable and worthy man. He died at Camberwell in February, 1852.

PROVENÇAL POETS were romantic poets of chivalry in the twelfth and thirteenth centuries in the south of France and in the adjoining parts of Spain. The language known as Provençal was that one of the Romance languages which was earliest formed, and which is least removed from their common parent, the Latin of the vulgar. The domain within which this language was spoken extended over the whole of the south of France, as far as the Loire, and Catalonia and Valencia in Spain. It was called the *langue d'oc* from its affirmative *oc* (derived from the Latin *hoc*), to distinguish it from the language of Northern France or *langue d'oui*, and it acquired the name of Provençal from the district (Provence) in which it was first cultivated as a literary medium. It was also sometimes called Limousine, from the region where it was spoken with the greatest purity. Southern France, already refined by colonies from Greece, and by its vicinity to the Romans, favoured with a milder climate and a freer government, was, until the eleventh century, far in advance of the north in civilization, and its language was distinguished for clearness, tenderness, sweetness, and copiousness. The language, the cultivation acquired by the nobles through their intercourse with the East, particularly with the poetical Arabs, an imagination awakened, and an understanding enlarged by travel and adventure, a romantic spirit, and the wealth produced by commerce—all these circumstances contributed to foster genius and to produce poetry. The poet sang of war and adventures, religion and love, and found encouragement and applause, particularly from the ladies, who were celebrated in his verses. The Virgin Mary was a frequent subject of their praise. The taste for poetry became general among the nobles and cultivated classes in Provence, and the princes, particularly Raymond Berengarius III. (1168–81) and IV. (1209–45), favoured the poetical art. In their court, at that time the most refined and splendid in Europe, it was customary to collect a circle of noble poets, called Troubadours (Italian, *trovatori*), a name corresponding to the Norman-French Trouvères or Trouveurs. At times the chivalrous festivals of Provence were disturbed by the noise of arms in some private feuds between powerful barons, or were interrupted by the attacks of the Normans or Moors; but the inroads of these plunderers on this coast were neither frequent nor destructive. Sometimes the desire of adventures, or the cry of war in foreign countries, summoned the knights of Provence to the battles of the other European nations. Thus, for instance, in the wars of King Alfonso VI. of Castile with the Moors, many knights of the south of France fought under the Spanish Cid, and aided in conquering Toledo, by which means they came into close connection with Arabian civilization. The Crusades, to which the first impulse was given in the south of France, at Clermont, in 1095, by Pope Urban VII., and which had so decisive an influence on the whole of Europe, were also felt in Provence. A single war took place upon the happy fields of Provence, which was fatal to the prosperity of that country, and to the poetry of the Troubadours, which never recovered from the effects of it. This was the iniquitous crusade against the Albigenses, in the beginning of the thirteenth century, when the ancient family of the counts of Toulouse was ruined, and the whole land filled with scenes of cruelty and bloodshed.

During this whole period courtesy and gallantry were nowhere so fully developed as in Provence; and we need not be surprised when we see the Emperor Frederick Barbarossa in Germany and King Richard Cœur de Lion in England inviting the Provençal knights to their courts to receive instruction from them in the usages and ceremonies of chivalry. Provence was the native land of the courts of love; and besides the inferior courts of this kind, as numerous as the castles of the viscounts and barons, there were four stationary courts of love at Pierrefeu, at Ramagny, at Aix, and at Avignon. The royal court in Provence, at Arles, was from the times of Boso I. (879), for almost two centuries, the theatre of the finest chivalry, the centre of a romantic life. The assembly of knights and Troubadours, of Jongleurs (musicians who accompanied the Troubadours), with their Moorish story-tellers and buffoons, of ladies acting as judges or parties in matters of courtesy, exhibits a glittering picture of a mirthful, soft, and luxurious life. The knight of Provence devoted himself to the service of his lady-love in true poetic earnest, and made the dance and the sport of the tilt-yard the great business of his life. Each baron, a sovereign in his own territory, invited the neighbouring knights to his castle to take part in tournaments and to contend in song, at a time when the knights of Germany and Northern France were challenging each other to deadly combat. There might be seen the joyous companies of ladies and knights under fragrant olive groves, upon the enamelled meadows, sporting from one holiday to another; there the gallant knight broke his lance on the shield of his manly antagonist; there the princess sat in the circle of ladies, listening seriously to the songs of the knights contending in rhymes respecting the laws of love, and at the close of the contest pronouncing her sentence (*arrêt d'amour*). Thus the life of the Provençals was lyrical in the highest degree; and if it degenerated in later times to voluptuousness and licentiousness this was owing to the want of a strong moral principle. Their poetry was necessarily lyrical, the expression of their feelings and passions. Even deeds and facts were represented merely through the medium and in the form of feelings. Such a poetry could never be more than a continual improvisatory effusion. It was necessarily superficial: it could be of value only with the accompaniment of music, and was not suited to be preserved in writing. With the Troubadour himself his songs lived and died. With regard to rhyme and to the modern metres the Provençals claim not only the merit of having first made use of them, but also of having fixed the form which rhyme and metre assumed in the romantic poetry. In their rhymed metre they have seldom gone beyond the simple

iambic, which they exchanged, mostly in those feet of the verse upon which there is no stress, for the trochee, pyrrhichius, and spondee; so that if their verses (usually of ten syllables) only had the cæsura and the final syllable sufficiently accented, they cared little about the measure of the other syllables. But they were very fond of complicated rhymes. We find in their stanzas not only the same rhyme repeated through a long series of verses, or the same rhymed word returning at the end of every other verse, but variously intertwined rhymes, in terzinas and other metres, distinctly point out the pattern of Petrarca's canzone and sonnets. As a specimen of the Provençal Romance idiom, and of their metres, we give the following stanza of a sirvente of William de St. Gregory, with its translation, taken from Roscoe's translation of Sismondi:—

'Be m play lo douz temps de pascor
Que fai fuelhas e floras venir;
E play mi quant aug la vandor
Dels auzels que fan retentir
Lor chan per lo boscatge
E plai mi quan vey sus els pratz
Tendas e pavallos fermatz;
E plai m'en mon coratge
Quan vey per campanhas rengatz
Cavalliers ab cavals armatz.'

The beautiful spring delights me well,
When flowers and leaves are growing;
And it pleases my heart to hear the swell
Of the birds' sweet chorus flowing
In the echoing wood;
And I love to see, all scattered around,
Pavilions and tents on the martial ground;
And my spirit finds it good
To see, on the level plains beyond,
Gay knights and steeds caparisoned.

What we have left of the poetry of the Troubadours are songs of contention (*tensones* or *jocs partitz*), in which some disputed point usually relating to love was discussed in alternate strophes by different minstrels; satires; martial and other serious songs on political and religious subjects (*sirventes*—so called as being composed in the service of a master); and numerous small songs (*chanzos*), war songs, songs of pastoral life and love (*soulas, lais, pastourelles*), morning songs and serenades (*aubades* and *serenades*), *retrouanges*, and *redondes*, the latter distinguished by artificial burdens. The poetry of the Troubadours, as in the course of time it became more common, was degraded, not unfrequently, to mere ballad singing, and was exposed to much mockery, of which the nobler singers often bitterly complain. The biographies of the Troubadours furnish us with a greater variety of matter than their poetry, which, through all its periods, turns continually upon the same subjects. The works of Nostradamus and Crescimbeni are well worthy of being read, and with them the critical extracts of Millot, from the collection of St. Palaye. Some of the most remarkable Troubadours were the following: in the van of the royal and princely singers is William IX., count of Poitou and Duke of Aquitaine, equally famous as a poet and a warrior (born 1071). He was followed by the foreign princes and lords, who gladly saw the exotic plant of gallant poetry transplanted to their courts—the Emperor Frederick Barbarossa, Roger of Naples, Richard Cœur de Lion, with his famous minstrel Blondel, who composed also Provençal verses, and who, according to tradition, discovered the prison of his king by means of his harp; the kings Alfonso and Peter of Arragon, and a vast number of princes and counts in Spain, France, and Italy. The most renowned of the rest of more than 200 Troubadours whose names and poems have been preserved, are Sordello of Mantua, celebrated for his chivalrous exploits and the praises of Dante; Peire Cardinal, distinguished for his religious and moral sirventes, and also author of the only Provençal fable; Guillem Figueras, composer of a sirvente full of fiery declamation against the Romish see; Arnaut Daniel, the most famous of the authors of tensones, and the introducer of the measure called the sextine (borrowed from the Italian); Pons de Capdoile, Peire Vidal, Gaucelm Faidit, and other authors of crusading songs; Peyrols, the happy as well as unfortunate servant of the sister of the Dauphin of Auvergne, wife of the Baron of Mercœur; Bertrand de Born, who is connected with the romantic adventures of Richard Cœur de Lion; Arnald de Maraviglia, who was devoted to the noble lady De Beziers, an eminent Troubadour and valiant knight, whose motto was 'A Dieu mon âme, ma vie au roi, mon cœur aux dames, l'honneur pour moi.'—See Sismondi, De la littérature du midi de l'Europe; Diez, Die Poesie der Troubadours (Zwickau, 1827); and Leben und Werke der Troubadours (1829); Galvani's Osservazioni sulla poesia de' Trovadori (Modena, 1829), and Fiore di storia letteraria e cavalleresca della occitania (Milan, 1845); van Bemmel, De la langue et de la poésie provençales (Brussels, 1846); Milá y Fontanals, De los Trovadores en España (Barcelona, 1861). There is, as yet, no collective edition of the works of the Provençal poets; but among the selections may be mentioned Raynouard Choix des poésies originales des Troubadours (Paris, six vols. 1816–21); Mahn, Die Werke der Troubadours (Berlin, 1846); and Gedichte der Troubadours (Berlin, 1860 fg.); Brinckmeier, Blumenlese aus den Werken der Troubadours (Halle, 1849).

PROVENCE, one of the old provinces of France, lying in the south-eastern part of the country, on the Mediterranean, bounded on the north by Dauphiné and Venaissin, on the east by Piedmont, and on the west by Languedoc. The capital was Aix, and the province was divided into Upper and Lower Provence. The departments of the Mouths of the Rhone, the Lower Alps, and the Var, with a part of that of Vaucluse, have been formed from it. Greek colonies were founded here at an early period (see MARSEILLES); and the Romans having conquered all the south-east of Gaul (B.C. 124–123) gave it the name of *Provincia Gallia*, or simply *Provincia* (the province), whence its later name was derived. Even after the rest of Gaul had been reduced by Cæsar to the condition of a Roman province, the name of Provincia still remained in common use as a designation of that portion of Gaul, which, in the division of that part of the empire made under Augustus, was called Gallia Narbonensis. In the first half of the fifth century the Visigoths obtained possession of a large part of Gaul on the west of the Rhone, and the Burgundians of the portion on the east side of the Rhone, from the Lake of Geneva to the Durance. The Roman territory in this quarter, and with it the name of Provincia, were thus restricted to the district lying between the Durance, the Alps, and the Mediterranean. About 470 even this remnant was snatched from the Romans by the Visigoths, who remained in possession of it till early in the following century, when they were obliged to resign it to Theodoric, king of the Ostrogoths, in return for the assistance he had rendered them against Clovis, king of the Franks. Less than thirty years after (about 536) the Ostrogoths were in their turn conquered by the Franks, and the Provincia or Provence incorporated with the dominions of the latter. In the partitions which took place under the sons of Louis the Debonnaire Provence fell first to Lothaire, and next to Charles the Bald. On the death of Louis the Stammerer (879) it became a part of the Burgundian

kingdom of Arles. The counts of Arles, however, who held the greater part of Provence, and were hence also called counts of Provence, were only slightly dependent on the Burgundian kings. The male line of the counts of Provence became extinct with Bertrand II. in 1093. For some time after his death (1093–1100) the land was governed by Bertrand's mother, Etiennette, and for a few years longer (1100–12) by his sister Gerberge. In 1112 the territory was acquired by Raymond Berengarius, count of Barcelona, by marriage with Douce, daughter of Gerberge. During his reign part of Provence (which now included somewhat more than the district inclosed by the Durance, the Rhone, the sea, and the Alps) was claimed by the Count of Toulouse as the inheritance of his grandmother, daughter of one of the previous counts of Provence; and in 1125 a treaty was concluded between the two counts, according to which the Count of Toulouse received the counties of Voleur, Die, Orange, and Venaissin; and the Count of Barcelona received Provence proper (which then, and till 1365, included Nice) and the county of Forcalquier, that is, the district immediately to the north and west of the Durance. In 1166 Raymond Berengarius II., grandson of the first of that name, died without male issue, and the possession of Provence was contested by the Count of Toulouse and Alfonso II. of Arragon, who belonged to another branch of the counts of Barcelona than that which had hitherto ruled Provence. The King of Arragon was successful, and gave his newly acquired territory to his brother Raymond Berengarius III., who retained it till his death in 1181. Provence then passed to Sancho, another brother of Alfonso, and in 1185 to a son of Alfonso of the same name, who, on his father's death in 1196, assumed the title of Alfonso II. Alfonso II. was succeeded in 1209 by Raymond Berengarius IV., with whom in 1245 the male line of the house of Barcelona, under whose patronage Provençal poetry had attained its greatest perfection, died out. Beatrice, the daughter of Raymond, inherited Provence on her father's death, and on her marriage in the beginning of the following year to Charles of Anjou, brother of the French king Louis IX., and afterwards King of Sicily, the land passed to that house, with which it remained till Joanna I. of Naples in 1382 appointed Louis of Anjou, brother of the French king Charles V., her heir. The counts who followed Louis of Anjou were Louis II. (1384–1417), Louis III. (1417–34), René the Good, duke of Lorraine (1434–80), and Charles III., count of Maine (1480–81). By the last count the territory was bequeathed to Louis XI. of France, by whom it was united to the French crown.

PROVERBS are the flower of popular wit and the treasures of popular wisdom; they give the result of experience in a form made impressive by rhyme, alliteration, parallelism, a pointed turn, or a comparison drawn from the most ordinary scenes and occurrences of life, which, by the force of association, makes their effect strong and permanent. Proverbs may be unassuming, lively, grave, or even sublime; their general character is *naïveté*. The habit of men at the present day to communicate so much with each other by writing, which, exciting the feelings less than conversation, leads to a less animated mode of expression, and the disposition to avoid what is common, springing from the pride of intellectual cultivation incident to an advanced stage of society, and various causes connected with the progress of civilization, make proverbs every day more unfashionable with the most civilized European nations, particularly in this country, where the use of a proverb (except it be one of a foreign nation) is considered almost vulgar; and the same contempt for these jewels of the multitude has spread to America. Another reason for proverbs going out of fashion may be, that the better a proverb is the more trite it becomes; and what is trite is vulgar, and what is vulgar is inelegant. Thus a public speaker could not use the proverb, ''Twixt cup and lip is many a slip,' at least not without some apology for its triteness, although the very triteness in this, as in most other cases (such as often quoted verses), proves merit; and even this homely proverb undoubtedly has often led to care and thoughtfulness. Proverbs often save long explanations by presenting a striking image; and many a lecture has probably been superseded by the French adage, 'One spoonful of honey attracts more flies than a hundred barrels of vinegar.' So they may be often used with effect to point the conclusion of a discourse. A period on the failure of men who strive beyond their capacity, might be well closed by the Arabian saying which Burckhardt mentions, 'If God purposes the destruction of an ant he gives her wings;' and the vanity of human resolutions could hardly be set in a stronger light than by the Portuguese proverb, 'Hell is paved with good intentions'—a proverb which, until it has become familiar, is awfully impressive. It requires skill to apply proverbs elegantly and judiciously in common life. As to the general worth of proverbs, we would say with one of their number, *Vox populi vox Dei.* Yet there are many directly opposed to others, and they must always be received *cum grano salis;* they are general views of things, and 'no rule without an exception.' Proverbs are plain-spoken. In their view, as in the eye of the law, all are equal. They take cognizance of the virtues, and vices, and follies of all classes, without respect of persons. They pierce the object at which they aim, and this in fact gives them currency, and makes them what they are. Boileau speaks of happy expressions,

> 'Qui, par le prompt effet d'un sel rejouissant,
> Deviennent quelque fois proverbes en naissant.'

Such a phrase is Napoleon's, 'There is but one step from the sublime to the ridiculous,' which may be almost said to have become a proverb, as is the case with many other expressions struck out in happy moments, or proceeding from conspicuous persons. The proverb is nearly related to the motto, symbol, device, sentence, apologue, fable, &c.; and the limit cannot always be easily drawn. Burckhardt gives us the following as Arabic proverbs: The wolf was asked, 'For what art thou following those poor little sheep?' He replied, 'The dust upon which they tread is good for my poor little eyes.' And this: one man said to another, 'O slave, I have bought thee.' 'That is thy business,' replied he. 'But wilt thou run away?' 'That is my business,' replied he. These having at once a narrative character, and a concise pointed expression, partake of the nature of the apologue and the proverb. Certain sallies of popular humour, ludicrous personifications, &c., which are frequently repeated, are sometimes called proverbs; as, 'What a dust we kick up, as the fly said to the cart-wheel.' Proverbs being the offspring of popular feeling and experience often serve, of course, to keep alive the recollection of peculiar views and customs, and a collection of the sayings of different nations would form an exceedingly useful and interesting work. Burckhardt collected at Cairo a number of Arabic proverbs, which have been published in a quarto volume, under the title Arabic Proverbs, or the Manners and Customs of the Modern Egyptians (London, 1830). The proverbs of Meidani, a famous Persian author, were translated from the Arabic by Edward Pocock, but the translation remained in manuscript in the Bod-

leian Library at Oxford till 1773, when some fragments were published by Albert Schultens, at London, under the title Specimen proverborum Meidani, ex versione Pocokiana. The collections of English and Scotch proverbs are numerous; we may merely specify Ray's, Allan Ramsay's, and Henderson's. A collection of Welsh proverbs was published by one Nicholas Hyll in the sixteenth century. A comprehensive polyglot collection of proverbs by Wander, began to be published at Leipzig in 1863. See Trench's Proverbs and their Lessons.

PROVERBS, one of the canonical books of the Old Testament. It derives its Hebrew name, as usual with the Jewish writers, from its first word *mishlê*, the plural of *mâshâl*, which literally signifies a similitude, but is applied alike to a dark prophetic utterance, a parable, and a proverb. The common title of the book among the ancient Christian fathers was *hē panaretos sophia*, 'the all-virtuous wisdom.' The book is usually in the main ascribed to Solomon, in accordance with the superscriptions in chap. i. 1; x. 1; xxv. 1, which, if not written by Solomon himself (as the first two of them may have been), at least represent the traditional views of the ancient Jewish church. Chap. xxx. and xxxi. are by the same authority ascribed to Agur and King Lemuel, but no information is given relative to the date of these persons, or as to who they were. Such is the traditional Jewish belief, but modern criticism has frequently come to a different conclusion. According to many modern Biblical critics the book of Proverbs should be broken up into several portions, written by different authors, and at different times, and finally collected into a single book at some period subsequent to the return from the captivity. All seem to be agreed that some part of the book is to be ascribed to Solomon, but there is great diversity of opinion as to how large his share is. Some attribute to him the greater portion of the proverbs contained in chap. x.–xxii. 16, and a considerable number of those in chap. xxv.–xxix. And of those attributed to Solomon the source is differently given. Some are thought to have been copied from written documents, others from traditions of the wise king's sayings current among the people. Thus, chap. i.–ix. are very commonly supposed by the school referred to not to have been written by Solomon. But those who agree in this point differ widely from one another on collateral questions. While Eichhorn and Ewald maintain that it is the composition of a single writer, according to Bertheau several authors had a hand in it. Davidson thinks that in the main it is the product of one mind, but that there are several portions introduced from other sources, as chap. vi. 1–19; ix. 7–10. Hitzig maintains this to be the oldest part of Proverbs, while Davidson sees in it evident marks of a date later than the section extending from chap. x.–xxii. 16, and Ewald places it at a time much later than that ascribed to it by Davidson. With respect to the main collection of proverbs found in chap. x.–xxii. 16, while there is a greater disposition to conform to the ancient tradition of their authorship, there is also a wide departure from it. Davidson, while he attributes the greater number of the sayings to Solomon, refers some of them to oral and others to written sources; and he thinks that the compiler of this collection mixed with Solomon's the proverbs of other peoples, and some also of his own. Hitzig, however, maintains that they bear evidence of having been the composition of a single writer; while Bertholdt argues that they must have proceeded from various sources, and that many of them contain internal evidence that they are not Solomon's. With regard to the other two contributors to Proverbs named in the book itself, Agur and Lemuel, nothing whatever is known; and in the case of Lemuel it is even suspected that the name is not that of a real personage, but merely a symbolical name for Solomon, for it is thought unlikely that the Jews would expressly borrow any of their proverbs from a foreign source, which must have been the case if the present text is retained, describing Lemuel as a king, and the person so named is taken as a real person different from any of the Jewish kings. The canonicity of the book of Proverbs is represented as a subject of dispute in the Talmud, some having objected to receive the book as canonical on account of the contradictions it contains. It ultimately found its place, however, in all the Jewish lists of the sacred writings, and its claim to a place there is held to be confirmed by the frequency with which it is quoted and referred to in the New Testament. It is assigned by the Jews to the third division of the Old Testament, by them termed Kethubim, or, in the language of Jerome and the early Christians, Hagiographa or Sacred Writings, and occupies a different position in the different lists of these writings.

PROVIDENCE, a city and port of the United States, in Rhode Island, of which it is the largest place, on both sides of the Providence or Seekonk, here crossed by two bridges, at the head of Narraganset Bay, 40 miles S.S.W. of Boston, with which and with New York city it is connected by railway. It is one of the capitals of Rhode Island, Newport being the other. It contains a great number of fine buildings, particularly in the eastern division; but is on the whole irregularly and indifferently built, consisting for the most part of wooden houses. One of the busiest, and at the same time most attractive parts of the town, is at the common terminus of the railway-stations, the buildings of which, not excelled by any in the United States, are ranged along three sides of a beautiful sheet of water of an elliptic form, about 1 mile in circuit, communicating with the bay, and having its banks laid out so as to form an excellent promenade. The ecclesiastical edifices are numerous, and some of them handsome. Other buildings and objects deserving of notice, are the State House, built of brick; Dexter Asylum for the poor, a plain and substantial brick building, situated within an inclosure of 40 acres; Brown University; Butler Hospital for the insane, a splendid and richly-endowed establishment; the Athenæum; the Friends' Yearly Meeting Boarding-school, popularly known as the Quaker College; a fine range of buildings chiefly occupied with public offices, and having a masonic hall in the upper story; the arcade, intended only for retail trade, is one of the most beautiful buildings in the country, and has its front ornamented with massive granite columns, each of a single block 22 feet high; the state prison; and a new and elegant theatre. Communication with the various quarters of the city and with the neighbouring towns is kept up by tramway cars. Manufactures have made great progress, and employ not only the large amount of water-power furnished by the Pawtucket Falls, but numerous steam-engines. The principal public works are flour and saw mills, mills for sawing and polishing marble; cotton and woollen factories, foundries, steam-engine and boiler factories, machine-shops; printing, bleaching, calendering, and dye-works, &c. Other articles manufactured are jewelry, muskets, cannon, and cannon-balls, leather, furniture, carriages, screws, nails, india-rubber shoes, small-wares, &c. It has a safe and commodious harbour, though it is somewhat difficult of access. Its foreign trade is small, but the coasting trade is important, and a considerable number of vessels are employed in the cod and other fisheries. Providence was first settled in the year 1636, and incorporated in 1649.

During its early existence it suffered much from the ravages of the Indians, in what is called King Philip's war. In 1801 a conflagration laid a large part of it in ashes, and in 1815 a severe gale raised the tide 12 feet above its usual level, by which 300 buildings were thrown down, and a great amount of property was destroyed. Pop. (1880), 104,857.

PROVINCE (*provincia*), among the Romans, a district of conquered country, governed by a proconsul or proprætor, and called therefore *provincia consularis* or *prætoria*. But this name was only applied to lands lying beyond the boundaries of Italy. The first Roman province was Sicily, which became one in 241 B.C., after the conclusion of the first Punic war. From the time of Augustus they were divided into the *provinciæ senatoriæ* or *populares* (the people's provinces) and the *provinciæ imperatoriæ* (the emperor's provinces). The latter comprised those which were most exposed to hostile inroads, and the administration of which was left entirely to the emperor under the pretence of sparing the senate and people the trouble of managing them, but in reality to keep the army in his own hands. They were different according to circumstances. Under the empire the provinces were much better governed than they had been under the republic. One reason of this was that the emperors were more disposed to pay regard to the complaints of the provinces than the republican courts had been, for the latter were largely composed of men who had themselves profited or who hoped to profit by the same kind of maladministration with which the governors were charged, and were therefore always willing if possible to connive at such offences. In addition to this the provincial governors under the empire received fixed salaries, which lessened the temptation to resort to illegal exactions to indemnify themselves for the expenses that they necessarily incurred in soliciting the office that was an indispensable condition of their governorship. Important changes were made in the administration of the provinces by Diocletian and Constantine at the end of the third and beginning of the fourth century. The most important of these was the withdrawal of the military command from the governors and the intrusting of it to specially appointed officers. See PROCONSUL and PROPRÆTOR.

In modern times the term has been applied to colonies or to dependent countries at a distance from the metropolis, or to the different divisions of the kingdom itself. Thus the Low Countries belonging to Austria and Spain were styled *provinces*. The different governments into which France was divided previous to the revolution were also called provinces. The name has sometimes been retained by independent states. Thus the Republic of Holland, after it had thrown off the Spanish yoke, was called the United Provinces; and the Argentine Republic used to be called the United Provinces of the Plata. In the canon law the term is applied to the jurisdiction of an archbishop. In the Roman Catholic Church it is also given to the territorial divisions of an ecclesiastical order such as the Franciscans, as well as to those of the Propaganda.

PROVINS, a town in France, in the department of Seine-et-Marne, 30 miles east of Melun. It is surrounded by walls flanked with towers, and generally well built. The principal edifices are a large tower, commonly called Cæsar's Tower; and the church of St. Quiriace, a large and handsome structure with a dome surmounted by a belfry. Provins is an ancient town, being mentioned in a capitulary of Charlemagne in 802. In the fortress, which formed the nucleus of the town, the sons of Louis le Débonnaire imprisoned their brother Charles in order to exclude him from the succession. In the middle ages important fairs, which were frequented by traders from all parts of France as well as foreign countries, were held here. The manufactures consist of linsey-wolsey, leather, bricks, lime, and spirits distilled from beet-root and sorghum; and there is a considerable trade in corn and flour for the Paris market, wool, leather, and roses called *provins*, which have been cultivated from time immemorial within the district. Near it are strong chalybeate springs. Pop. (1881), 7728.

PROVOST (from *præpositus*), in the Scottish burghs, the title of the chief magistrate, corresponding to the English mayor. The provosts of Edinburgh, Glasgow, Aberdeen, and Perth have the title of lord-provost; while the provost of Edinburgh is further called the right honourable, and the provost of Glasgow the honourable. The heads of several of the colleges in the Universities of Oxford and Cambridge are also styled provosts. In ecclesiastical law a provost is the chief dignitary of a cathedral or collegiate church. See also PRÉVÔT.

PROVOST-MARSHAL, in the army, is an officer of the rank of a captain, who takes cognizance of offences against discipline, orders the arrest and the punishment of deserters and other offenders according to the sentence of the court-martial. He has also a power of inflicting summary punishment under the Mutiny Act. The provost-marshal in the navy has somewhat analogous functions.

PRUDENTIUS, AURELIUS CLEMENS, one of the early Christian poets, born at Calagurris in Spain in 348 A.D.; died after the beginning of the fifth century, practised first as an advocate, and afterwards rose to be a governor. In his latter years he became more retired, and composed a great number of songs or hymns, partly for family use, and partly in praise of the martyrs, or on similar subjects of a religious nature. His verses display the characteristics of the time, but contain many beautiful thoughts. The best edition is that of Obbarius (Tübingen, 1845).

PRUD'HOMMES, CONSEILS DE, courts of conciliation in France for deciding small disputes between workmen and employers. The first councils called by this name in Paris were formed in 1296 in the reign of Philippe le Bel, when twenty-four *prud'hommes* were appointed to assist the provost of the merchants in settling disputes between the merchants and manufacturers who attended the fairs and markets of the town. In 1464 Louis XI. permitted the burghers of Lyons to choose a *prud'homme*, whose functions were similar to those of Paris. A still more ancient institution of the same kind existed in Marseilles and other maritime towns for enforcing the fishing regulations of the port and settling disputes among the fishers. At a later period a tribunal of this kind existed at Lyons for judging the disputes between the silk manufacturers and their workmen. It was suspended by the laws which swept away all private privileges at the revolution; but inconveniences having been occasioned by its abolition, it was reconstituted in 1803. Similar tribunals were established in other towns, and laws passed at various times to regulate them. After the revolution of 1848, at which period seventy-five towns had conseils de prud'hommes, the whole legislation on this subject was revised. By the law passed 27th May, 1848, all the patrons and workers of industrial establishments within the circle of jurisdiction of the council of prud'hommes were made eligible as electors, a patron and a working-man must preside alternately for three months in the electoral colleges. The diets of conciliation must consist of two members, one a patron and one a worker; and four of each class constitute the general council. In June, 1853, a law was passed, which, with some modifications, is still

in force. The patrons and the workmen are formed into separate electoral colleges, the latter including managers and foremen, each to elect an equal number of prud'hommes. Half the number are re-elected every three years, the retiring members being re-eligible. The electors are convoked by the préfet. The general council, besides the president and vice-president, is composed of equal numbers of patrons and workers. The judgments of the council must be signed by the president and secretary. The jurisdiction of the councils is summary and without appeal for sums under 200 francs; above that sum an appeal lies to the tribunals of commerce. When a judgment is given for more than 200 francs, immediate execution without security may be ordered up to that amount. A supplementary law of 24th May, 1864, on the discipline of conseils de prud'hommes provides for the performance by the members of these councils of their duties. By the law of 1853 the presidents and vice-presidents of the conseils de prud'hommes are appointed by the emperor (now by the executive power), and need not belong to either of the classes from which the other members are chosen. This is the most serious innovation on the law of 1853. There were 102 conseils de prud'hommes in France in 1873.

PRUNES. See PLUM.

PRUNING is the severing of portions of the stem, branches, shoots, leaves, or roots of a plant for the purpose of removing excrescent or unprofitable growths, and rendering the sap more conducive to the nutrition of the valuable parts of the plant. Pruning is especially necessary to trees which are subjected to artificial treatment. For example, the branches are free to point in all directions, but when trained against a wall they are limited to a flat hemispherical surface, on which the whole natural development of the tree cannot be disposed without crowding. Although, if the soil is good, the root might sufficiently nourish the superfluous growth, the leaves and shoots could not be duly exposed to the light. The immediate effect of pruning is to reduce the growth of a plant in as far as it depends on the amount of foliage duly exposed to the light; but as by judicious pruning the parts left have not only a greater share of sap, but are better exposed to the light, its ultimate effect is to produce a larger and stronger plant.

Fig. 1.

The tendency of sap to flow in increased quantity into the parts immediately adjoining those where its flow has been interrupted gives an almost unlimited power to the gardener of controlling the direction of the growth of a plant. For example, in fig. 1 there are two shoots, *a* and *b*, and it is desired to have two others at the heights *c* and *d*. To insure this the upright leading shoot is pruned off in winter at *e*. The upward flow of the sap thus diverted will be exerted on the immediately adjoining parts, and the three buds immediately below the section will almost certainly push into shoots, the uppermost supplying the upright leader, the other two the side shoots, which will tend in the direction of the dotted lines. By cutting at *g* the three lowest buds on the upright stem might have been developed in like manner.

To train plants by pruning, however, requires experience and judgment. Suppose it is wanted to form a head at *a*, fig. 2, with a clean stem from the ground up to it, how should we proceed? The most obvious way might seem to be, after pruning at *a*, to cut off at once all the branches from *b* to *i*, and this has often been done in such cases. But this is overlooking the fact that the parts above ground have an important function to perform in the nourishment of the plant. The ascending sap from the root is only fit for nourishing the plant when it has undergone the organic changes due to the action of air and light exerted upon it in its passage through the vascular system of the leaves, and the roots themselves are nourished, like other parts of the plant, by the returning flow of sap thus prepared. On the branches between *b* and *i* there would be a greater aggregate breadth of foliage than between *i* and *a*. If on all the shoots between *b* and *a* there should be 125 leaves, and only twenty-five between *i* and *a*, by cutting off all the shoots between *b* and *i* the entire plant would be deprived of four-fifths of its means of growth. So severe a privation would seriously check the development of the roots; and though the buds below *a* might freely appropriate all the sap diverted by the excision, it would be very limited in amount. But if the plant is in a healthy growing state it may be deprived of a moderate portion of its foliage without injury; and when the deficiency has been made good by a new expansion of foliage on the remaining parts, another portion may be cut off, and so on. Thus in fig. 2 we may cut off the lower branch close to the stem at *b*, and the two next shoots may have their points pinched off at *e* and *d*. This will divert part of the flow of sap from these shoots into the upright stem and the remaining laterals, so that their foliage will expand more rapidly. The two shoots stopped at *e* and *d* may then be cut off at *c* and *f*. This will probably be enough for one season, with the exception of pinching the tops of one or two more if they appear to grow too vigorously. In the autumn, when the wounds already made have been healed by a new growth of alburnum, or in early winter, the remaining shoots may be cut off, after which the buds above *i* will in due course swell boldly and push vigorous shoots. For a similar reason the upright stem above *a* may be allowed to remain during the first pruning operations, and be cut off in autumn when the foliage between *i* and *a* has become developed. In like manner a single stem for growing wood may be developed by judicious pruning, while the natural growth would have dis-

Fig. 2.

tributed the wood in a variety of comparatively useless branches. Bent or kneed timber can also be produced with the aid of pruning in a variety of ways, as by bending the central shoot when young, or by diverting the principal growth into a naturally divergent limb.

The proper time for pruning varies according to the nature of the plant and the object to be promoted. Deciduous trees should not generally be pruned in spring, as the active circulation of the sap will cause them to be impoverished and often to die from bleeding. A little pruning may be performed in summer, for the purpose of securing a larger exposure to light; but autumn or winter is generally the best season for extensive pruning. Pruning in spring not only weakens the plant, but is liable to alter the quality of the sap and induce disease. This probably arises from the sap flowing from the root in greater quantity than can be converted for the purposes of nutrition. Pruning in autumn produces vigorous shoots, and the excess of vigour sometimes requires to be abated. For this purpose summer pruning is best adapted. When a plant is cut in autumn to a given form, the upright shoots will naturally outgrow the others, and alter the form in summer. Summer pruning is best adapted to check this overgrowth, as it is less liable than autumn pruning to increase the flow of sap to the immediate vicinity of the point of excision. If in summer the parts are reduced to an equal quantity of efficient foliage, their growth will probably continue equal.

Root-pruning consists in shortening the roots of a plant. Its immediate effect is to reduce the supply of nourishment, and by checking the rapidity of growth, it has within certain limits a tendency to promote the development of blossom-buds. When roots are injured by transplantation, it is generally better to cut the bruised or lacerated parts clean off, as the young roots are thereby encouraged to push from the sound portion. When root-pruning is used to check excessive vigour it must not be done to a greater extent than will just suffice for the immediate purpose. As in the case of branches, it is better that extensive pruning should be effected by stages. The best time for root-pruning for fruit-trees is immediately after the leaves have fallen in autumn, or before the sap has begun to flow actively in spring. Taking up fruit-trees every second year and replanting them is now recommended by good authorities as preferable to root-pruning.

PRURIGO, a disagreeable and severe itching affecting the skin, belonging to the class of diseases called papular, consisting of the elevation of minute papulæ or points upon the surface. It occurs most frequently in spring or summer, and is commonly connected with derangement of the digestive organs. The treatment consists in clearing the bowels by a cooling aperient and the use of the warm bath, or in obstinate cases of the sulphuretted bath. A variety called *prurigo senilis* is sometimes connected with chronic disease of the viscera. This form of the disease alone is dangerous, and may be incurable.

PRUSSIA (German, *Preussen;* French, *Prusse*), KINGDOM OF, the leading state of the German Empire, comprising the greater part of North Germany, forms a tolerably compact territory extending from lat. 49° 6′ to 55° 35′ N. and lon. 5° 50′ to 22° 15′ E. It is bounded south by France, Bavaria, Saxony, Bohemia, and Austrian Silesia; west by France, the Netherlands, and Belgium; north by Denmark and the Baltic; north-east and east by Russia. The length of Prussia is 700 miles from east to west, and breadth 470 miles north to south. After the war of 1866 Prussia annexed the Kingdom of Hanover, Electoral Hessen, Duchy of Nassau, free city of Frankfort, Duchy of Schleswig-Holstein, portions of Bavaria (Caulsdorf, Gersfeld, and Orb), and portions of the Grand-duchy of Hessen (Landgraviate of Hessen Homburg, Amt Homburg, and Amt Missenheim); thus receiving an accession of 27,810 square miles of area and 4,285,700 of population. The names, areas, and population (according to the census of 1880) of the provinces into which the kingdom is divided are given in the following table:—

Area and Population according to the census of 1880 *of the Provinces of Prussia, with the names of the Governments contained in each.*

Provinces.	Governments.	Area—square miles.		Population, 1880.
East Prussia	Königsberg, Gumbinnen	14,277	.....	1,933,936
West Prussia	Danzig, Marienwerder	9,846	.....	1,405,898
Brandenburg	Berlin (City), Potsdam, Frankfurt	15,404	.....	3,389,155
Pomerania	Stettin, Köslin, Stralsund	11,629	.....	1,540,034
Posen	Posen, Bromberg	11,180	.....	1,073,397
Silesia	Breslau, Liegnitz, Oppeln	15,556	.....	4,007,025
Saxony	Magdeburg, Merseburg, Erfurt	9,746	.....	2,312,007
Schleswig-Holstein (including Duchy of Lauenburg*)	Schleswig	7,219	.....	1,127,149
Hanover	Hanover, Hildesheim, Lüneburg, Stade, Osnabrück, Aurich	14,856	.....	2,120,168
Westphalia	Münster, Minden, Arnsberg	7,800	.....	2,043,442
Hesse-Nassau	Kassel, Wiesbaden	6,138	.....	1,554,376
Rhineland	Koblenz, Düsseldorf, Köln, Trier, Aachen	10,414	.....	4,074,000
Hohenzollern	—	441	.....	67,624
Total		134,506		27,279,111
Population in 1875				25,742,404
Increase				1,536,707

* The Duchy of Lauenburg was annexed to Schleswig-Holstein on the 1st of July, 1876.

The average density of the population is over 191 to the English square mile; the increase since the census of 1875 is about 5·9 per cent. The effect of the Franco-German war is perceptible in a slight difference in the ratio of increase of the two sexes. The increase of population is much greater in the town than in the country districts. The total population of the ten largest towns of the kingdom in 1880 was 2,377,650, an increase of 315,712 since 1875. Omitting minor sects, Prussia had in 1880, 17,645,868 Protestants to 9,206,283 Catholics.

Prussia is naturally divided into two great sections, the one of which, by much the larger of the two, belongs to the great European plain, and may be called the Prussian plain, while the other in the south-west belongs to the German plateau, and may be called the Prussian table-land. It will be well to treat them separately in describing their geographical features.

PRUSSIAN PLAIN.—The whole of northern and eastern Prussia, from Holland on the west to Russia on the east, may be described generally as a vast plain,

considerably elevated in the south and south-west, and thence descending at first rapidly, and afterwards very gradually, towards the Baltic and the German Ocean. The loftiest summits are on the southern frontiers of Silesia, where the Riesengebirge and the Sudetes form the boundary between it and Bohemia and Moravia, and send northwards several ramifications which, without attaining a very lofty height, form wild and romantic scenery, averaging about 2220 feet in height, but lowering northwards to an average of 900 feet; after which the surface loses its hilly character, and begins to form extensive plains. In the south-west, the only other quarter which can be considered mountainous, ramifications of the Thuringian forest and of the Harz appear, and cover a considerable portion of the southern part of the province of Saxony, but here the average height does not exceed 1000 feet, and soon diminishes to less than 500 feet. The large space extending between the northern foot of these mountain districts and the shores of the Baltic does not present the appearance of a monotonous flat, but though generally low and tame, heathy and swampy, is often finely diversified, and even rich in scenes of rural beauty. Ultimately, however, in approaching the shores of the Baltic and North Sea, the general level becomes so low that large tracts are saved from inundation only by low sand-hills or banks of gravel which the waves have thrown up. Behind these hills and banks extensive lagoons, on the Baltic coast called Haffs, have been formed, communicating with the sea by narrow outlets, and giving to the shore one of its characteristic features. The whole coast is flat and uninteresting. Very few undulations occur to break its monotony; no bold cliffs appear, and the water shallows so much that good harbours are extremely rare. The only large gulf is that of Danzig, within which the town of the same name possesses by far the most frequented port. On the Baltic coast are the islands of Wollin, Usedom, Rügen, Fehmern, Alsen, &c., and in the North Sea are the North Frisian Islands and the East Frisian Islands.

Rivers and Lakes.—The whole of this portion of the Prussian monarchy belongs to the basins of the Baltic Sea and the North Sea. The principal river which drains it is the Elbe, which, entering from the north of Saxony, traverses it by a series of remarkable bends, mainly in a N.N.W. direction, and finally, after passing through Hanover, enters the North Sea between that province and Holstein. The chief affluents which join the Elbe between Saxony and Hanover are the Black Elster, the Mulde, the Saale (which receives the White Elster), and the Havel. The Weser, with its tributary the Aller, and the Ems, are the principal rivers west of the Elbe. The share of drainage received by the Baltic is conveyed to it by a number of large and independent streams. Of these, commencing with the eastern boundary of the basin of the Elbe, the most important is the Oder, the only large river which can be considered wholly Prussian, since its course, with exception of its commencement as a mere mountain torrent, lies wholly within its territory, which it traverses circuitously S.S.E. to N.N.W., receiving the Malapane, Bartsch, and above all the Warta, augmented by the Netze; and the Neisse of Silesia, the Bober, and the Neisse of Görlitz, and entering the Baltic by the Pommerische Haff. Next in importance to the Oder, and communicating with it by a canal between the Braa and the Netze, is the Vistula or Weichsel, of whose course only the lower part belongs to Prussia, which it enters from Russian Poland, flows in a northern direction without receiving any large affluent, and throws off two large branches which enter the Frische Haff, while the main stream continues its course past Danzig to the gulf of that name. Between the Oder and Vistula a number of small streams, among which the Rega, Persante, Wipper, Stolpe, Lupow, and Leba may be mentioned, carry their waters directly to the sea, and thus form small independent basins. To the east of the Vistula the first river of importance is the Passarge, and after it, still further east, the Pregel, with its tributary Alle. The last river on the east is the Niemen or Memel, which has only a small part of its lower course in Prussia, but penetrating far into Russia, forms one of its important navigable outlets. Lakes abound in almost every province, but more especially in those of Prussia proper, including East and West Prussia, and of Pomerania and Brandenburg. The large lagoons such as the Pommerische Haff, Frische Haff, and Curische Haff, with many others of a similar description lining the coast, have been already referred to. The inland lakes are far too numerous to admit of specification. In East Prussia alone 115 have been counted, though their extent individually is so small that the whole area occupied by them is not more than 320 square miles. West Prussia counts 58 inland lakes, Pomerania 66, Brandenburg 131; there are also many in Posen and in Schleswig-Holstein. Many of these lakes are well supplied with fish, but generally possess few attractions, either in themselves or in the scenery around them.

Geology.—Tertiary strata prevail over almost the whole of the level portion of Prussia. In the mountainous districts of the eastern part of the monarchy the loftier summits are composed of granite, gneiss, mica schist, porphyry, diorite, &c. These are most largely developed in the mountains of Silesia, and even in some of its flatter parts, and are also seen in the circle of Schleusinger, in the Saxon government of Erfurt, in the Brocken, forming part of the Harz, and in isolated spots in the vicinity of the town of Halle. Metamorphic rocks, clay-slate, and limestone extend along the frontiers of Austrian Silesia into the Upper Silesia of Prussia as far as the Oder, and also north of the Riesengebirge, in the districts of Schweidnitz and Waldenburg, and west to the Queiss. Rocks of the same formation occupy a considerable part of the flatter districts of Prussian Saxony, more especially in the vicinity of Magdeburg, and along the banks of the Ohre. Secondary formations, composed of mountain limestone and the various strata of the carboniferous system, occur in Silesia, chiefly in two localities in Upper Silesia along the frontiers of Cracow and Russian Poland, and among the mountains in the county of Glatz, and towards the Riesengebirge. Rocks still higher in the series, and including the new red sandstone and others, enter Prussian Silesia from Poland on the east, and extend west to the Oder near Krappitz, and to a considerable distance inland. They also occupy an extensive tract in the province of Saxony, covering part of the terraces of the Thuringian forest, and stretching along the northern and eastern foot of the Harz to the banks of the Saale, Elster, and Elbe. Chalk and its accompanying beds occur in many different localities, more especially on the north side of the Harz, and in Silesia, both in its higher districts and on the frontiers of Poland. Chalk also appears near Inowraclaw, in the province of Posen, near Templin, and Prenzlow, in the government of Potsdam, near Gutzkow, in the government of Stralsund, and lastly in the island of Rügen, where it forms the romantic cliffs of Stubbenkammer and Arkona.

Climate.—The above described portion of Prussia, extending over 6° of lat. and about 16° of lon., and consisting in one direction of lofty mountains, and in another of low flats stretching along an inland sea, and inclosing between them large tracts of undu-

lating land, must necessarily present considerable diversities of climate. At Erfurt, in lat. 50° 59′ N., and about 900 feet above the sea, the temperature of the year is 52° 1′; of winter 34° and of summer 71° 20′ Fahr. At Berlin, in lat. 52° 30′ N., but at a much lower level, only 130 feet, the annual temperature is the very same, though both the extremes of winter cold and summer heat are somewhat greater. At Stralsund, in lat. 54° 19′ N., but at a level rather under 50 feet, the temperature of the year is 51° 48′; of winter 32° 30′, and of summer 68° 30′ Fahr. The average of a number of places situated between the highest and lowest latitudes gives a mean annual temperature of 52° Fahr. At Berlin from 159 to 160 days of the year are rainy, from 33 to 34 obscured with mist, and 17 stormy. On the coast of the Baltic the stormy days amount to thirty, the greater part of them in summer; and the quantity of rain is also much increased. Least rain falls in Silesia and the eastern provinces. The prevailing winds are west and south-west.

Prussian Table-land.—The south-western division of Prussia, consisting of the greater part of Westphalia, the Rhenish province, and Hessen-Nassau, differs so much from the eastern division as, in many respects, to present a striking contrast to it. All the mountainous parts of the former are situated on its southern and western frontiers, and on receding from them long tracts are wandered over in which nothing that can be called a mountain is to be seen. The present division of the monarchy is much more finely diversified. Its mountains, though far less elevated than those on the frontiers of Silesia, are not confined to a particular locality, but stretch across the country in all directions, and form numerous valleys, one of which, that of the Rhine, here occupies no inconsiderable portion of the whole surface, and in point of fertility and beauty is not surpassed by any other valley in Europe. Towards the north of the Rhine valley a mountain range of moderate elevation, forming a continuation of the Wesergebirge, stretches across the governments of Minden and Münster. To the south of it that of the Teutoburger-Wald extends in a north-west direction, and near Bielefield attains its loftiest height, not exceeding 1030 feet. This is succeeded, to the south, by a low range, known by the name of the Haar or Haarstrang, the highest point of which is scarcely 700 feet. This range, commencing between Brilon and Stadtberg, stretches west across the north of the government of Arnsberg, in the direction and along both banks of the Möhne and Ruhr, presenting to both rivers, and on both sides, but particularly on the south, a number of bold and romantic precipices. Still further south the Sauerland or Süderland Mountains appear. Towards the east, where they take the name of the Rothlager or Rothhaar, they attain their highest elevation, which, in the Astenberg, is 2625 feet, and in several other summits exceeds 2000 feet. The last range, on the east or right bank of the Rhine, is the Westerwald, which reaches the height of 2000 feet. A part of this range, forming its western termination, stretches along the banks of the Rhine, and presents the remarkable summits known by the name of the Siebengebirge. On the left bank of the Rhine, and on the southern part of the Rhenish province, the principal mountains are the Eifelgebirge, which have their greatest breadth between Andernach and Bonn, stretch from the Rhine westward for about 45 miles, and, though generally low, attain the height of 1590 feet; and the Hundsrück, occupying a large space between the Moselle and the Nahe, and attaining, in the loftiest summits of the Iderwald and Hochwald, the respective heights of 2260 and 1560 feet.

Rivers.—By far the greater part of this portion of the Prussian monarchy belongs to the basin of the Rhine, which, entering it on the south-east, traverses it in a N.N.W. direction, and enters Holland to the north of Cleves. It thus receives a large part of the drainage of the region directly, and is, moreover, augmented within it by numerous streams, of which the most important are, on the right bank, the Lahn, the Sieg, the Wipper or Wupper, the Ruhr with its tributary Lenne, the Emscher, and the Lippe; and on the left the Nahe, the Moselle with its tributary Saar, and the Erft. In the north-west a considerable space belonging to the basin of the Rhine is drained by the Maas or Meuse, and its tributaries the Roer and Niers. The rest of the drainage, forming a small portion from the north and east, is shared by the Ems and the Weser. There is not a single lake deserving of notice for its magnitude. The most remarkable is Laachersee, about 6 miles from Andernach, occupying, apparently, the crater of an extinct volcano, and, though of small extent, above 214 feet deep.

Geology.—In this part of Prussia there are no primitive rocks of granite, gneiss, and mica-slate. The prevailing rocks, particularly in the south, are volcanic, and consist chiefly of basalt, augite, porphyry, and similar volcanic products of the tertiary period. The secondary formation, and more especially mountain limestone, and the overlying strata of the carboniferous system, are largely developed in the north, in the circle of Tecklenburg, in the government of Münster, at the north-western foot of the Sauerlandgebirge, along the Ruhr, between Arnsberg and Düsseldorf in the west, at the northern foot of the Eifel, near Aix-la-Chapelle, and in the south, in the government of Treves, particularly in the neighbourhood of Saarbrück. The New Red Sandstone, with its accompanying rocks and fossils, occupies a considerable part of the higher districts in the government of Minden, and also occurs on parts of the Eifel, and along the Moselle and Saar, in the government of Treves. Lias and Oolite are found in the north among the hills which lie between the Weser and the frontiers of Hanover. The chalk formation has its largest development in Westphalia, more especially on the western side of the Teutoburger-Wald, in the Sauerlandgebirge, between the Ruhr and the Lippe, and more partially in the government of Münster.

Climate.—Within the same ranges of latitude, and at nearly equal heights above the sea-level, the climate of the western is superior to that of the eastern division of the monarchy. The mean annual temperature is about 1° higher, the winter is milder, and the summer cooler, and the range of the thermometer is accordingly confined within narrower limits. The fall of rain, however, is greater, averaging 20 inches in the west and only 15 inches in Silesia and the eastern provinces. This, however, cannot be considered a disadvantage, as the larger quantity of the western is by no means in excess, and only tends to make vegetation more luxuriant.

The principal physical features of the two great divisions of the monarchy have now been considered separately, but it will not be advisable to follow the same course in considering its industrial resources, both because the most important statistics relating to these are often so lumped together that it is scarcely possible to separate them, and the same branches of industry are common to both divisions.

Agriculture.—The land in Prussia is much subdivided, especially in the more populous districts, small farms of 3 or 4 acres being the most common holding. The possessors of landed property amount to nearly 5,000,000, and the numbers engaged in agriculture to about 12,000,000, showing a very large proportion of proprietors. The whole monarchy is

situated between the parallels of latitude under which all the ordinary cereals are easily matured, and there is nothing in the elevation of the surface, except in a few particular localities, to unfit it for general cultivation. In the more southern portions, even though only to a limited extent, the vine thrives well, and yields some wines of good repute. The arable and garden land is about 50 per cent. of the whole, meadows and pastures 18·3 per cent., woods 23·1 per cent., unproductive territory, 8·5 per cent. The soil includes all varieties, from light sands, almost carried by the wind, to the most obdurate clays, but has been subdivided into the three classes of wheat land, light loams of middling quality, and sandy or stony land. The wheat land, which is in most cases remarkably productive, is found chiefly in the Prussian provinces near the frontiers of Poland, and along the banks of the Memel and Pregel, till the coast is approached, when the sandy soil begins to prevail, in the province of Posen, in the government of Breslau, on the east bank of the Oder, and generally throughout Silesia, between the Oder and the mountains. In Brandenburg the wheat land occurs only in isolated spots, with the exception of a rich continuous tract which extends along the Oder from Frankfurt into the north of the government of Potsdam. The same tract, spreading out into a broad zone, occupies a large portion of Pomerania, both extending north to the extremity of the Isle of Rügen and west to the Prussian frontier. In the province of Saxony the wheat land occurs chiefly in the southern part of the government of Magdeburg, where a plain, known by the name of the Magdeburger Börde, is considered the richest and best cultivated in the monarchy, and also occupies a considerable part of the government of Erfurt. In Westphalia it forms the southern part of the government of Minden, where the Warburger Börde is celebrated, and extends through part of the government of Arnsberg, particularly in the vicinities of Söst and Hellweg. Still more productive tracts are found in the northern half of the Rhenish province, between Aix-la-Chapelle and Bonn, as far as the frontiers of the Netherlands, and in the southern districts of the government of Treves, along the banks of the Saar. The loams of middling quality prevail in the government of Bromberg, the northern part of Silesia, generally throughout the province of Brandenburg, in the eastern half of the government of Merseburg, the north of Magdeburg, the eastern part of Minden, the whole of the government of Münster, and lastly, in the government of Coblenz. The sandy and stony land of barren quality is found in large continuous flats in the governments of Gumbinnen and Königsberg, where, for the most part, it forms the northern boundary of the heavy wheat land. It prevails in the governments of Danzig and Marienwerder, generally along the shores of the Baltic, along the frontiers of Silesia, particularly in the southern and eastern districts. In the interior of the province of Brandenburg, too, though the very heart of the monarchy and in the environs of the capital, the soil belongs decidedly to this class, consisting of immense tracts of sand which spread out like a sea, while occasional patches of middling or even fertile wheat land, rise up and appear like islands in the midst of it. Nor are similar tracts unknown in the western division of the monarchy. Besides small stretches in the government of Minden, and a large tract in the west of Münster, the sandy and stony ground forms the larger part of the government of Arnsberg, which lies along the Sauerlandgebirge, whence the very name of Sauerland has been derived from the sterile and sourish nature of the soil. Similar ground occurs in the governments of Cologne and Coblenz, and on the plateaux which reach to the Westerwald. The different soils above described, and the extent of the districts over which they spread, furnish us with an easy means of ascertaining the nature of its different products. On the first soil, as its name indicates, wheat is the prevailing crop, and alternates chiefly with hay and beans. The yearly produce of wheat, after satisfying the home consumption, leaves on an average a considerable surplus for export. The produce of rye, barley, and oats is three times as great as that of wheat, but the consumption of these kinds of grain being far greater leaves only about the same quantity for export. Another very important crop, the culture of which is more or less extensive in every district, is that of potatoes. Of these a great proportion are consumed by the distilleries alone. Hemp and flax are also very important crops, more especially the former, which furnishes large supplies for the home manufactures, though a large quantity still requires to be imported. Tobacco also, to the extent of above 20,000,000 lbs., is annually raised. Anise and cummin are cultivated on a large scale, particularly in Saxony and Brandenburg. Oil plants are also important objects of culture, both for their oil and for their seed. The latter, particularly linseed, forms an important article of export from Eastern Prussia, while almost equally large exports of clover and other hay seeds take place from Brandenburg and the Rhenish province. To the latter province also the culture of the vine is chiefly confined. The largest space occupied by vineyards is in the governments of Coblenz and Treves. The culture, on a smaller scale, is carried on in the governments of Cologne and Aix-la-Chapelle, and also in Saxony, Brandenburg, Posen, and Silesia. Beet-root is cultivated to a great extent, and a large proportion of it is used in the manufacture of sugar. In raising these various crops the system of agriculture pursued, though much improved in recent times, is still very defective, and not only falls far short of that common in the best cultivated districts of our own country, but is surpassed by many of those on the Continent. The same remark applies to the breeds of domestic animals, in which great improvement still requires to be made, though much has been done by the government, more especially in the case of horses, by the establishment of breeding studs in different localities, and on a general system. Considering the large extent of sea-coast, the vast number of lakes, and the number as well as magnitude of the rivers which Prussia possesses, its fisheries cannot fail to prove an important source of revenue. The whole produce has been estimated at about £1,000,000 sterling, of which little more than a fourth is obtained from the sea.

Minerals.—These include among metals silver, iron, lead, copper, zinc, cobalt, arsenic, antimony, and manganese; and among other minerals salt, alum, copperas, coal, lignite, roofing slate, gypsum, millstone, limestone, and several varieties of excellent building stone. The silver, found only in connection with copper, is worked chiefly in the district of Mansfeld, in the province of Saxony, and more partially in some localities in Westphalia, and at Tarnowitz in Upper Silesia. The produce has for a long time been gradually diminishing, but still amounts to about one-sixteenth of the whole produce of Europe. Iron is very generally diffused; copper is found in the three localities above mentioned for silver; lead is found in Silesia, the Rhenish province, Westphalia, and Saxony; zinc in the same localities, except Saxony; cobalt in Westphalia and Saxony; arsenic in Silesia; antimony and manganese are also obtained in considerable quantities. Salt is found in all the provinces except Prussia proper, Posen, Brandenburg, and Silesia, but the quantity obtained falls far short of the consumption, and requires to be supplemented

by imports from England, Spain, and Portugal. Amber is found in large quantities along the shores of the Baltic, and also obtained by digging at some distance inland. Coal is found in Upper and Lower Silesia, in the provinces of Saxony and Hanover, but above all, in Westphalia and the province of the Rhine. The mines of the Ruhr-Düsseldorf district, lying in both the last two provinces, are the most productive in the kingdom, contributing about half the entire produce. Those of the river Saar, in the south-west angle of the Rhenish provinces, though less extensive, are next in productiveness, and supply about a sixth of the entire produce. Coal is exported to Southern Germany, France, and Switzerland. More than nine-tenths of the coal raised in Germany is the produce of the Prussian mines. The production of coal in Prussia has increased rapidly and pretty steadily from about 1840, the growth having been checked only in the three years 1872–74. In the years 1838–41 the average annual production was 2,901,713 tons; in the years 1842–46, 3,817,190 tons; in the years 1852–56, 8,571,070 tons; in the year 1871, 32,843,288 tons; in 1874, 31,938,683 tons; and in 1881, 43,780,000 tons. Lignite is still more widely diffused, but the principal beds are in the province of Saxony on the Saale, the Mulde, and the lower Bode; and in Brandenburg on the Oder and elsewhere. The most important beds of iron ore are in the circle of Siegen (in Westphalia), in the province of the Rhine, on the Lahn in Hesse-Nassau, and in Upper Silesia. The following table gives the main particulars for the year 1881 regarding the mining operations of Prussia for the five minerals which rank next in importance after coal:—

Minerals.	Produce.	
	Quantities. Tons.	Value.
Lignite,	10,412,000	£1,563,450
Iron ore,	3,906,000	1,321,150
Zinc ore,	659,200	447,200
Lead ore,	148,800	915,840
Copper ore,	515,400	693,000

Manufactures.—These have made great progress, and are not confined to any particular districts, but generally diffused over all the provinces. At the head of the ordinary tissues stands linen, which, according to the industrial census taken in 1875, then occupied 90,228 persons. Of these, however, only a small proportion were employed in factories and similar manufacturing establishments; the great majority of the looms being domestic, and only used as subsidiary to other employments. Only 390 establishments employed more than five persons. In almost all these domestic looms only goods of a coarser description are made. Silesia, Brandenburg, and Westphalia are the provinces in which this branch of industry is chiefly developed. The linen manufactures are exported to different countries. The tissue next in importance is cotton, the manufacture of which has its chief seat on the Rhine, particularly in the neighbourhood of Düsseldorf, but is also carried on to a considerable extent in Silesia, particularly in the government of Breslau, and also in the province of Brandenburg. It employed at the same date 60,657 persons. The woollen, like the linen manufacture, is carried on to a large extent domestically, chiefly in the government of Gumbinnen, where the peasantry weave enough of coarse woollens to supply their own wants; but the manufacture, properly so called, has its chief seats in Brandenburg and the Rhenish province. Silk and velvet employed 55,016 persons, mainly in the government of Düsseldorf. The greater part of the remainder are at Berlin. In connection with the above tissues, and properly forming branches of the same manufactures, vast quantities of yarn, worsted, and cotton-twist are spun. The first continues to be spun chiefly by hand, the flax-mills throughout the monarchy numbering only ninety-one. The number of persons employed in this branch of industry was 21,567. The worsted is chiefly, and the cotton entirely, spun by machinery. The former has its principal seat in the province of Brandenburg, especially in the government of Frankfurt, and after it in the Rhine province. The cotton-mills are situated chiefly in the basin of the Rhine, and to a more limited extent in Silesia. The whole number of persons employed in the textile industries in 1875 was 441,968, but to these a considerable addition should be made for the great number of persons employed in bleachfields, printfields, and dye-works. The manufactures in metal rank next in importance, and in 1875 employed 246,953 persons, exclusive of those employed in the making of machinery, who numbered 91,980. In 1876 there were 160 manufactories of wrought iron, employing 19,001 persons; 785 of cast iron, employing 68,998 persons; 54 of steel, employing 22,997 persons; and 32 of zinc, employing 5845 persons. In iron and steel ware the first place belongs to the Rhine province and the Westphalian government of Arnsberg. Among particular localities may be specified Solingen for its fine saws and tools, Aix-la-Chapelle and Burtscheid, Altena and Iserlohn for needles and pins, Remscheid and Hagen for locks and various similar kinds of hardware. In the same localities, also, brass-ware, including wire and thimbles, are made on a very extensive scale. Berlin has long been famed for its fine castings, many of which, whether as articles of ornament or utility, are unsurpassed. In connection with these may be mentioned type-founding, which, as well as printing, forms an important branch of industry in Berlin. The leather manufacture is also important, and includes, in addition to ordinary leather, the finer varieties of red and white cordovan, and parchment. Pottery in all its varieties forms an important branch of industry. For porcelain and the finer kinds of ware Berlin and St. Martin, near Trier, are the most celebrated localities; excellent stoneware of a more common description is made extensively in the south of the province of Saxony, in Liegnitz, and in the Rhenish province. Common pottery is made in all the provinces, more especially in those of the east and centre. One of its most celebrated localities is Bunzlau. Glass does not rank high as a Prussian manufacture. The principal localities are the governments of Trier, Minden, and Oppeln. The most important paper-mills are in Silesia, Saxony, and Westphalia; but the quality of the paper is still far inferior to that made in Great Britain, France, and Switzerland. Other manufactures carried on to such an extent as to be of national importance, are beet-root sugar, chocolate, chicory, chemical products, and tobacco. Of these the last is the most important, and is carried on in very extensive factories in the Rhenish province, in Brandenburg, and Saxony. It employed in 1875, 59,648 persons. The last manufactures deserving of notice are beer and spirits, the consumption of which is immense, and might with great advantage be very much diminished. The greatest number of distilleries is in the Rhine province, though Silesia has also a very large number. Taking the whole raw materials used in producing the spirit at 100, potatoes form 75, barley 12, rye 10, and wheat about 1 per cent. The whole produce amounts to about 80,000,000 gallons. Of the breweries the Rhine province has above one-fourth, Westphalia and Silesia each one-sixth, and Saxony one-eighth. The produce is about 315,000,000 imperial gallons. Sparkling wines are made near Coblenz and elsewhere.

Trade and Commerce.—The principal exports of Prussia are grain, flax, linseed, rape, turnip, and clover seed, timber, lime, gypsum, linen and linen yarn, brandy, coal, earthenware, wool, woollen cloth, hosiery, and zinc; the principal imports cotton and cotton twist, colonial produce, particularly raw sugar for refining, potash, iron, raw hides, wine, herrings, salt, &c. The establishment of the Zollverein, by giving a free interchange of communication between the different states belonging to it, made it difficult to specify the exact amount of trade which each state possesses, but there cannot be a doubt that that of Prussia is very extensive. The German customs and commercial union, the maintenance of which was assured until 1877 by the treaty concluded at Berlin, on 8th July, 1867, between the North German Confederation and Bavaria, Würtemburg, Baden, and Hesse, by the thirty-third article of the Constitution of the empire, was, with the exception of some small territories, made co-extensive with the frontiers of the empire, and the federal council of the Zollverein was merged in the federal council of the empire. Both from the nature of the country and the number of navigable streams which intersect it, it enjoys great natural facilities, and these have been very greatly extended both by common roads, canals, and railways. The last mode of communication has already made great progress. Prussia had on the 10th of May, 1883, 9369 English miles of railway belonging to the state; 1584 miles belonging to private companies, but under state management; and 2464 miles owned and managed by private companies, making a total of 13,416 miles. All these were in operation and others were then in course of construction. The private lines under government management were partly constructed with money derived from state loans or subventions. All the lines of Hanover, Hesse, and Nassau are now owned by the state, and the whole of the railways of Prussia will by and by become national property. The external communications of Prussia are more defective than its internal, the Baltic, notwithstanding its long line of coast, being only an inland sea, deficient in good harbours. The principal ports of Prussia are now Memel, Pillau, Königsberg, Danzig, Colberg, Swinemünde, Stettin, Wolgast, Stralsund, Kiel, and Flensburg on the Baltic; and Altona, Harburg, Geestemünde, Leer, and Emden on the North Sea. The merchant navy of Prussia in 1882 consisted of 2955 vessels, of 460,548 tons register, of which 203, of 54,745 tons register, were steamers. Among the foreign vessels which trade to Prussian ports the tonnage of Great Britain is about one-third more than that of any other nation. The second place is occupied by the Dutch, and the third by the Danes. In some of the ports of Prussia ship-building is carried on with activity. Stettin builds about one-third of the whole.

Coins, Weights, and Measures. See GERMANY.

Government.—Prussia is a monarchy hereditary in the male line, and from the absence of recognized constitutional checks was, previously to the European revolutionary movement in 1848, in theory absolute. The present constitution was mostly framed by the government, with the aid of the constituent assembly, in 1849, and proclaimed 31st January, 1850. It has been modified by royal decrees, of which no fewer than thirteen have been issued between April, 1851, and April, 1873. The king, whose functions are both executive and legislative, attains majority at the age of eighteen. He is assisted by a council of ministers appointed by royal decree. A representative assembly composed of two chambers shares the legislative authority with the king. The consent of the king and of both chambers is necessary to all laws. Financial projects and estimates are first submitted to the lower chamber, and must either be accepted without amendment or rejected by the higher. Each branch of the legislature has the right of proposing laws. The upper chamber or House of Lords (Herrenhaus), as modified by decree of Oct. 12, 1854, is composed of princes of the blood of the reigning and former sovereign families of full age, the heads of the mediatized principalities, sixteen in number; the territorial nobility created by the king, about fifty in number; life peers, chosen by the king from the large landowners, manufacturers, and eminent men of the country; eight titled noblemen elected by resident landowners of all degrees, representatives of the universities, heads of chapters, and burgomasters of towns with more than 50,000 inhabitants, members nominated by the king for life, or for a restricted period, of whom the number is not limited. The second chamber or House of Deputies (Haus der Abgeordneten), since the enlargement of the kingdom, consists of 432 members. The primary qualification of electors is based on taxation, and is the same as for municipal elections. The primary electors are divided into three classes, according to the amount of their taxation. The first division consists of those who pay the highest taxation, the second who pay the medium, and the third of those who pay the lowest amounts; and the numbers in each division are determined by the total amount of taxation, which is equally distributed between the three divisions. The indirect electors (Urwähler) elect the direct electors (Wahlmänner), who choose the representatives. The deputies are chosen for three years, and the new members must be elected within six months of the dissolution of the chamber. The chambers are regularly convoked each November. Members accepting office must be re-elected. Members of the second chamber receive 20 marks (£1) a day, acceptance of which is obligatory. A legal majority of members must be present when a resolution is decided on.

Finance.—The estimates of public revenue and expenditure submitted by the government to the chambers are now always made to balance each other, but the actual expenditure has in recent years usually been under the revenue, even in time of war, though there was a deficit in 1875, 1876, and 1877. In 1872 the surplus amounted to £4,158,000. Till 1876 the Prussian financial year was the same as the civil year, but at that date a financial year was adopted, ending as in this country on the 31st of March. The revenue and expenditure for the year 1883–84 were each estimated at an amount equal to £54,152,894. The total debt on the 31st of March, 1883, was £102,984,071. A large part of the debt has been incurred for the construction of railways, and is a profit-bearing investment. The state railway debt amounted at the date above mentioned to a little over £20,239,000.

Justice.—This is administered in most of the provinces according to a general code or Landrecht established in 1794, but in the greater part of the Rhine province according to the French code, subject, however, to certain modifications. For each code a supreme court sits at Berlin, the one called the Geheime Obertribunal, which judges in the last resort wherever the Landrecht is in force; and the other, called the Rheinische Revisions-und-Kassationshof, which has similar jurisdiction in all cases decided according to the French code. Over each province a superior appeal court, called Oberlandesgericht, presides, with a power of reviewing all cases decided within it; and in each government is an Obergericht, possessing a right of reviewing the cases decided within the government in the courts of primary resort. These last courts consist of a vast

number of local jurisdictions, within which justice is said to be for the most part administered cheaply, expeditiously, and purely, by judges chiefly appointed by the crown, but partly also by private parties in possession of certain patrimonial rights.

Religion.—Though the reigning family is Protestant there is no exclusive religious establishment. The principles of religious toleration are professed, and persons of all denominations are alike eligible for public employment, and possess the same civil rights. The state, however, distinctly recognizes the two great bodies of Protestants and Roman Catholics, not only protecting them in their respective rights and properties, but directly interfering in their affairs, more especially in regard to the appointment and payment of their ministers, and to their general management. The Protestants are governed by consistories, at the head of which are superintendents. The Roman Catholics are governed by two archbishops and six bishops.

Education.—Prussia has taken the lead of Europe in the establishment of a complete system of national education, and has succeeded not only in placing an excellent course of elementary instruction within the reach of the great body of the people, but in inducing, and when that fails, in compelling, them to receive it. The consequence is that it is exceptional, especially in the western provinces, to meet with an individual that cannot both read and write. In the eastern provinces, Posen, East and West Prussia, and to a less extent in Silesia, the state of affairs is not quite so satisfactory. This happy result has been obtained first by establishing an adequate number of schools in all parts of the monarchy, and then enforcing attendance by a law, which provides that every child from the age of five years complete, unless certified to be receiving a suitable education at home or in a private seminary, must be in attendance at a national school, until the course of instruction therein provided has been received. The educational institutions of Prussia are divided into eleven classes, including technical schools and the universities. Prussia has ten universities—Berlin, Bonn, Breslau, Göttingen, Greifswald, Halle, Kiel, Königsberg, Marburg, and Münster. All private as well as public educational establishments are placed under the superintendence of the Minister of Public Instruction, and all public teachers are regarded as servants of the state.

Army and Navy. See GERMANY.

People.—The far greater part of the people are Germans, but in several quarters the Lithuanian and Slavonian stocks preponderate. Thus, in the north-east corner of the monarchy, between the Deine, Angerap, Goldapp, Pregel, and the Inster and Memel, Lithuanian is spoken, read, written, and taught. The Slaves occupy the south parts of Gumbinnen, Königsberg, and Marienwerder, the greater part of Posen, and no inconsiderable part of Silesia. French are found chiefly in the west part of the monarchy, but partly also in the province of Brandenburg, where they are descendants of the French Protestants who found an asylum here from the tyranny of Louis XIV.

History.—The Kingdom of Prussia, which, in the second half of the nineteenth century, and before the re-formation of the German Empire, possessed the most powerful organization and wielded the greatest and most compact military strength of any state in Europe, dates only from the beginning of the eighteenth century. The antecedent history of the growth of this state into a kingdom is divided, by the natural order of the circumstances from which it is derived, into two branches. The more important of these follows the rise of the Electorate of Brandenburg, which formed the nucleus of the future kingdom, and contained the principle of unity and the germs of vital organization which directed its growth. The other and less important branch relates to the province of Prussia, which incidentally gave its name to the kingdom, and which in one direction determined its external relations.

During the southern migration of the Teutonic races on the decline of the Roman Empire, the northern part of Germany as far west as the Elbe, and including the modern Brandenburg, was occupied by people of Slavonic race. When the divided empire of Charlemagne made way in the ninth century for a German kingdom military marches were established for the defence of the frontiers. Brandenburg, which had been conquered by Charlemagne in 789, was erected into a margraviate by Henry I. (the Fowler), king of Germany, in 926. Otto I. founded the bishoprics of Brandenburg and Havelburg. Albert the Bear, who received Brandenburg as a fief from the Emperor Lothaire (1134), conquered the Slavonian Wends, and took in 1157 the title of Margrave of Brandenburg. He also held the dignity of archchamberlain of the empire, which conferred the electoral dignity. He began the colonization of the country with German immigrants, which was continued under his successors. His dynasty continued to bear rule till 1320, and during this period German civilization was gradually extended in Pomerania, Saxony, Brandenburg, and Silesia. After its extinction there followed a period of anarchy. Brandenburg fell as a lapsed fief to the empire, and Louis of Bavaria gave it to his son. It continued in the Bavarian house for three successive electorates or reigns, and during this period it was named as one of the principalities to which the electorate was restricted by the Golden Bull (1356). It was subsequently ceded to the house of Luxemburg, and Charles IV., the first imperial representative of this house, gave it successively to his sons Winceslaus (1373) and Sigismund (1378). Sigismund sold the New March to the Teutonic knights in 1402, and twice mortgaged the Electoral March for his debts. On the second occasion, after he had become emperor, he received from Frederick, the burgrave of Nürnberg, a loan of 400,000 gold florins, for which the latter held Brandenburg in pawn for some years. The emperor then formally agreed to cede the electorate in liquidation of his debt, and Frederick, to whom the exchange was acceptable, was duly invested in it at the Diet of Constance in 1417, two years after John Hus had been burned by the decree of the council assembled at the same place. Sigismund was not aware that he had sold the reversion of the empire to a house who should become the champions of a creed similar to that for which Hus suffered, but to this result, through many remarkable vicissitudes, the course of events finally tended.

The burgrave who had acquired the electoral dignity in this mercenary manner was the descendant of Conrad of Hohenzollern, a cadet of a Suabian house, who had received in 1200 the appointment of imperial burgrave of Nürnberg, which had become hereditary in his family. The elder branch of the family continued to hold a small territory surrounding the ancestral castle of Hohenzollern, of which they traced their lordship back to the time of Charlemagne, till 1851, when they ceded it to Prussia, and were recognized as princes of the blood.

The territory which Frederick had acquired had relapsed under its imperial rulers into a condition of disorder and lawlessness. The feudal nobility had made themselves nearly independent. As in other parts of Germany they had covered the country over with their strongholds, which were little better than

the abodes of robbers. Frederick protected the towns from their depredations, and gradually reduced their castles. Before his purchase of the electorate he had acquired two small territories in Franconia, Ansbach, and Baireuth, the consequent union of which with the Kingdom of Prussia subsequently gave rise to important events. Frederick divided his possessions among his sons; the second, Frederick, succeeded to the electorate, and subsequently reunited the territories belonging to it. Frederick II., who succeeded his father in 1440, and who was surnamed the Iron-toothed, in honour of his military prowess, extended the possessions of his family by policy as well as by valour. He repurchased the New March from the Teutonic knights, to whom it had been sold by the Emperor Sigismund. In 1470 he abdicated in favour of his brother Albert III., surnamed Achilles, who, by a family ordinance (*Hausgesetz*), prepared the way in an important respect for the future greatness of his house. In our article GERMANY (see subdivision on the internal divisions and government of the empire) we have noticed the prevalence, even in the larger fiefs of the empire, of the partition of inheritances among heirs of like degree as a cause of political division, which, from the federal constitution of the empire and the quasi-independence of its princes, proved a source of weakness not only to the houses which adopted it, but to the entire state. This practice had been introduced in the Hohenzollern line of Brandenburg by its founder. The Hausgesetz provided for the undivided descent of the marches in connection with the electorate. Ansbach and Baireuth were permitted to go to separate heirs, but not more than two. A hereditary succession was thus secured, which, in the fluctuating state of other German houses, eventually made the house of Brandenburg an adequate rival to the imperial Austrian house, while the circumstance that the hereditary possessions of the former lay chiefly within, while those of the latter lay chiefly without the limits of Germany proper, finally turned the scale in favour of the more recently formed power. Albert resigned the active administration of the government to his son John Cicero in 1476. He died in 1486. John I. was succeeded in 1499 by his son Joachim I., who reduced the last strongholds of his recalcitrant nobility. He founded the first university in the electorate, that of Frankfort-on-Oder, in 1506; and he established a supreme legal tribunal (Kammergericht) at Berlin. He zealously opposed the Reformation, which during his reign spread rapidly in his dominions. In 1510 he expelled the Jews from his territory. His son Joachim II., who succeeded in 1535, embraced the Reformation, and established Lutheranism in 1539. This step also exercised an important influence on the fortunes of the house. Joachim acquired the title of Hector from the valour he displayed in the Turkish campaigns as imperial generalissimo. He confiscated the Catholic bishoprics of Brandenburg, Havelberg, and Lebus, and applied their revenues to the endowment of schools. In 1537 he signed with Duke Frederick of Liegnitz a hereditary union (Erbverbrüderung), by which the reversion of the principalities of Liegnitz, Brieg, and Wohlau was secured to the Hohenzollern house. The Seven Years' war and the acquisition of Silesia by Frederick II. of Prussia were the ultimate results of this agreement. He also acquired a title to the Duchy of Prussia, which will be afterwards alluded to. John George succeeded in 1571. He administered his states with a view to relieve them of financial embarrassments entailed by the profuse expenditure of his father. By welcoming the Dutch, who were driven from their country by persecution, he contributed to the industrial prosperity of his country. Joachim Frederick, who succeeded in 1598, married (1603) his son John Sigismund to the daughter of Frederick Albert, duke of Prussia. He effected in 1603 with his cousin George Frederick of Ansbach, on the basis of the Hausgesetz of 1477, the House-treaty of Gera, which was afterwards considered the fundamental law of the family. He was succeeded in 1608 by John Sigismund, who united the Duchy of Prussia to the electorate in 1618, and brought Brandenburg into contact with Poland.

We shall here give a separate outline of the history of this province to the point of junction. The coast territory between the Vistula and the Niemen was early occupied by a Lithuanian race called Prussians, whom the kings and clergy of Poland had long endeavoured to convert to Christianity. Probably the methods taken were not always of the most forbearing kind, and the Prussians returned the attentions bestowed on them by inroads on the Polish territory, which eventually became so alarming that the Poles called in the Teutonic knights of St. George to help them against their heathen neighbours. Having obtained on behalf of their order a grant from the emperor of all the Baltic lands they should conquer, the Teutonic knights began a war of conquest in 1231 under their general, Herman von Balek. The conquest was completed in 1283. The Teutonic knights removed their head-quarters from Venice to Marienburg. They did much to civilize the country and introduce the peaceful arts of agriculture and commerce. They reached their greatest prosperity about 1400, when fifty-five walled cities and forty-eight castles, with a large agricultural population, owned their sway. Their rule, however, was attended with the disadvantages of a despotic oligarchy. The Lithuanians united with the Poles against them, and they were defeated by Jagellon in the battle of Tannenberg, 15th July, 1410. Internal dissensions followed their defeat, and their power gradually declined until the conquests of the Poles compelled them in 1466 to accede to the Treaty of Thorn, by which West Prussia was ceded entirely to Poland, and East Prussia held by the grand-master as a fief of the Polish crown. The Teutonic order now sought the protection of the German princes by electing scions of the great houses to the grand-mastership. Margrave Albert of Brandenburg-Kulmbach, a nephew of Sigismund, king of Poland, was chosen grand-master, and installed in 1512. He refused to do homage to the King of Poland, who declared war on him in 1519. It was terminated by a four years' truce in 1521 through the mediation of the emperor and the King of Hungary. In 1524 Albert swore allegiance to the empire, and took his seat in the Diet of Nürnberg as an ecclesiastical prince. On the termination of the truce with Poland in 1525, Albert, who had embraced the Reformation, negotiated a treaty with his uncle, by which he renounced the ecclesiastical profession and received the investiture of the King of Poland as hereditary Duke of Prussia under the Polish crown, with the right of succession to all the possessions of the Teutonic order. Albert founded the University of Königsberg and established schools throughout his duchy. His son Frederick Albert succeeded in 1568. He became hopelessly lunatic, and his states had to be administered by a regency, which from 1608 was conducted by his son-in-law, the Elector John Sigismund, whose grandfather had, as already mentioned, acquired the co-enfoeffment of the duchy. On his death in 1618 the duchy was united with Brandenburg.

About the same time another important accession of territory was gained by the same elector. John William, duke of Juliers, Clèves, and Berg, Count of La Marck and Ravensberg, and Lord of Raven-

stein, died without issue in 1609. There were numerous claimants to the succession, among whom, in virtue of his wife, was John Sigismund. By the Treaty of Xanten (1614) Clèves, La Marck, and Ravensberg, being half the succession, were assigned to Brandenburg. Thus was laid the foundation of the Rhine province, which brought the future kingdom in contact with France. John Sigismund again changed the religion of his state by renouncing the Lutheran for the Calvinistic confession. He was succeeded in 1619 by his son George William. That terrible crisis in the affairs of Germany, the Thirty Years' war, had now arrived. George William was unequal to the occasion. His continued vacillation between the two parties probably contributed to protract the war, and brought all the evils of military occupation and exaction upon his own states from both sides, each of whom alternately treated him as an enemy. At first he adopted the side of his brother-in-law Gustavus Adolphus, but was soon swayed from it by his minister Count Schwarzenberg, a Catholic and partisan of the house of Austria. Even while he remained at peace with the emperor, Tilly and Wallenstein traversed his states and levied contributions from them unsparingly. Mansfeld and Gustavus Adolphus occupied them in turn, and he was compelled to cede to the latter the fortresses of Spandau and Küstrin. He afterwards took the side of Gustavus, but on his death made peace with the emperor, and again exposed his states to the incursions and exactions of the Swedish generals, who traversed them at their pleasure, and remained in occupation of them at his death in 1640. Thus a crisis which in the hands of a bold and skilful leader might have made the fortune of the rising state, brought it to the brink of ruin. At his death whole tracts of country were depopulated, agriculture was neglected, trade and commerce abandoned. It is rarely that such opportunities are lost with impunity, but fortune did not yet abandon the house of Brandenburg. Frederick William, son of the preceding, surnamed the Great Elector, and who may be regarded as the virtual founder of the Prussian monarchy, averted the progress of calamity, and soon gave a prosperous turn to the affairs of the state. Through the jealousy of Count Schwarzenberg he had passed his youth far from the court, and had been trained to arms in the camp of Frederick Henry, prince of Orange. A fuller account than we can here give of his reign will be found in our biographical article under his name. He began by concluding a treaty of neutrality with Sweden, by which he freed the electorate from hostile occupation. The Rhine province he cleared by armed force. At the Peace of Westphalia (1648) he was compelled to cede West Pomerania and the Island of Rügen to Sweden, and received in exchange the bishoprics of Halberstadt, Minden, and Kammin, with the reversion of the Archbishopric of Magdeburg and the lordships of Lora and Klettenburg. By the Treaties of Vehlau (19th September, 1657) and Oliva (23d May, 1660) he secured the recognition by Poland and Sweden of the independence of Prussia, and was recognized as sovereign by the Prussian states at Königsberg in 1663. Before securing the independence of Prussia he had, through the exigencies of war, transferred his allegiance from Poland to Sweden. He allied himself with the emperor and Holland against France and Sweden (1672), and conducted the war with remarkable vigour and success, but was compelled by the weakness of the emperor to make peace on disadvantageous terms by the Treaty of St. Germain en Laye (29th June, 1679). The Silesian principalities fell vacant during his reign, but the emperor refused to recognize his reversionary treaty-right, and appropriated them to himself as escheated fiefs. Circumstances only permitted Frederick William to protest. He formed a standing army, and in order to provide for its maintenance he violated the laws and the feudal privileges of his subjects, deprived the estates of Brandenburg and Prussia of the right of granting supplies, and reduced their power to a nullity. He thus founded the despotic power which so long distinguished the Prussian monarchy. Frederick William towards the close of his reign actively interested himself in the contemplated expedition of the Prince of Orange to England. He had promised his support to William, and engaged to release Marshal Schomberg, who was in his service, whenever William should require him to aid in the expedition. Frederick William died 29th April, 1688, and was succeeded by his son Frederick, the third elector of that name, and the actual founder in 1701 of the Prussian monarchy. The time had now come when the prudence and foresight which had directed the energies of a succession of able rulers, though interrupted at a momentous crisis by one incapable reign, was to meet its natural reward. The Great Elector had steadily directed his efforts to the centralization of the power of his states, and to the placing of the central power upon an independent footing. Nominally subject to the German Empire for the bulk of his possessions, the weakness of the central power of the empire was brought so familiarly within the range of his own observation and experience, that it did not require his sagacity to anticipate the probability of its decline or extinction. In a federal elective monarchy where the central power was strong, the ambition of the more powerful members of the confederation might be expected to turn on the hope of securing the reversion of the supreme power, and nothing would be done without a strong countermotive to weaken it. When in such a state the central power is weak, the possession of it implies danger, which those who have most to risk will commonly be most cautious of encountering. The strength of the central power of the German Empire had come to depend almost entirely upon the personal or hereditary possessions of its holder. When this is the case the risk is greatly increased by a transfer of power. The probable enmity or opposition of an excluded claimant, who, as the heir of the former holder, would imagine his right to be preferable, and the reluctance of the partisans of the old power to change their allegiance would at least have to be reckoned with. In such circumstances the ambition of the more powerful houses will naturally tend to independence, and this may explain how the elective succession continued almost without interruption in the line of Austria, which had become by far the most powerful of the German houses in respect to the extent of its hereditary possessions, while the central power itself, as represented by the diet, in which the influence of Austria was paramount, became gradually weaker. The final renunciation by Austria herself of the imperial power, together with the absorption of many of the weaker states by the stronger, though brought about by external events of the most violent kind, was not an unnatural issue of the internal organization of the empire itself. But of the German states, with the exception of Austria herself, none had been more successful in extending its power than the Electorate of Brandenburg. Its possessions lay more within the natural limits of the empire than those of the imperial house, and they had been consolidated as far as their situation admitted by the Great Elector into a homogeneous body. The electorate had thus become a kingdom in all but in name. It was a rising kingdom within a declining empire, and it was natural to wish that the name and rank of the state should correspond with its

means and power. This was the ambition of the new elector, and he found means to gratify it. Among the first acts of the elector were to join the Grand Alliance against France, in which, like his father, he was influenced by religious as well as by political views, and to do all in his power to forward the enterprise of the Prince of Orange, who was his uncle, on England.

Soon after the termination of the first war of the Grand Alliance (Peace of Ryswick, 1697) the elector entered into a treaty with the emperor, by which he received permission to assume the title of king in connection with his ex-German principality of Prussia. By this treaty, called the Treaty of the Crown, he engaged to support Austria in the diet, to give his electoral vote in favour of the emperor's son, and to maintain for the service of the empire an army of 10,000 men. These conditions, for the fulfilment of which there could be no guarantee, show as clearly the weakness of the emperor as the ambition of the elector Frederick immediately proceeded to Königsberg, and crowned himself King of Prussia on the 18th of January, 1701. The second Grand Alliance was concluded against France in September of the same year. In spite of the exertions of the emperor, the Elector of Bavaria and other German princes joined the French alliance, but the new Kingdom of Prussia sided with Austria and England, and the Prussian troops distinguished themselves by the side of the English at Blenheim, Ramilies, Oudenarde, and Malplaquet. Frederick died in 1713. His son, Frederick William I., an arbitrary and ignorant, but well-meaning despot, governed Prussia till 1740. His reign was on the whole peaceful, and as he did not neglect the material prosperity of his subjects, the country grew greatly in population, industry, and wealth. His parsimony enabled him to fill the public treasury without oppressing the country. His chief passion was for military drill, and he had a particular mania for cultivating a corps of tall soldiers. He went to war with Charles XII., and acquired part of Pomerania, with Stettin, from Sweden. He gave a dubious and lukewarm assistance to the emperor in the war of the Polish Succession. He left at his death a prosperous country, a well supplied treasury, and an army of 70,000 men to his successor. Frederick William has acquired the greater part of his renown from his treatment of his son. The king was a very strict Calvinist, and endeavoured to bring up his family with the most scupulous attention to their religious principles, but he was indifferent, or rather hostile to learning, and he proposed in his son's education to leave out the study of the classical languages, history, and literature. Frederick, who had acquired some literary tastes, was as much opposed to his father's plans as he was averse to the strictness of the discipline to which he was subjected. Having failed in an attempt to leave the country, he was banished from court. His father tried to induce him to renounce the succession, and but for the interference of the emperor, would probably have put him to death. Frederick II., surnamed the Great, who succeeded to the crown on the death of his father in 1740, was in many respects a contrast to his Lutheran and Calvinistic ancestors. The bigotry of his father had, by a natural reaction, driven him to indifference and scepticism in religion. His literary tastes had brought him into intimate and sympathetic relations with the philosophic liberalism of France. During his exile from court he patronized scholars and corresponded with Voltaire. The Emperor Charles VI. died on the 20th of October, 1740, and left his hereditary possessions to his daughter Theresa, and with them the Silesian principalities, which had been appropriated under protest of the Great Elector. The troubles which the succession of Maria Theresa was likely to occasion afforded Frederick the opportunity of enforcing his claim. He had been preparing for war from the time of his accession, without having definitely fixed on any object but the acquisition of glory ('La satisfaction de voir mon nom dans les gazettes'—Letter to Jordan). He invaded Silesia without ceremony, and then made proposals of alliance to Maria Theresa, which were rejected with indignation. The first encounter of his troops with the Austrians had very important results, for it showed the decisive superiority of the Prussian discipline and drill. In the matter of rapidity of firing their advantage appears to have been then as great as in the modern battle of Sadowa. Frederick was persuaded to flee on a preliminary defeat of his calvary, and learned at Löwen that his troops had gained the battle of Möllwitz, 10th April, 1741. At the persuasion of England Maria Theresa entered into negotiations with him, but failed in coming to an understanding, and Frederick, in a secret treaty with France, 5th June, 1741, acceded to the league formed against her by the Treaty of Nymphenburg, stipulating for a recognition of his right to Lower Silesia. By a treaty begun at Breslau, June 11, and concluded at Berlin, July 28, 1742, Frederick obtained from Maria Theresa, on condition of neutrality, the cession, with the exception of some specified districts, of both Upper and Lower Silesia, and of Glatz. Taking alarm at certain treaties concluded by Maria Theresa, which seemed to threaten an attempt to reconquer Silesia, Frederick entered into an alliance with the Emperor Charles VII. (the Elector of Bavaria, who had been unanimously chosen at the Diet of Frankfort, January, 1742), who had been driven from his dominions by the Austrians, and whom Frederick undertook with the assistance of France and Sweden to restore. It was secretly stipulated that Bavaria was to have Bohemia and Prussia Silesia. This treaty, called The Union of Frankfort, was signed by the emperor, the king, and other German princes, 22d May, 1744. In August Frederick invaded Bohemia, and commenced what is called the Second Silesian war. Prague surrendered to him on 16th September, but ill-supported by the allies, whom he had formerly deserted, he was compelled to retreat before the Austrians and Saxons. The Union of Frankfort was opposed by the Quadruple Alliance, including Austria, Great Britain, the Netherlands, and Poland and Saxony. In 1745 Frederick gained victories over the Austrians at Striegau, June 4, and at Sorr, September 30, but the death of the Emperor Charles VII. (January 20) had broken up the alliance, and the English ministry exerted themselves to restore peace. Maria Theresa was unwilling to come to terms, but the continued success of the King of Prussia, who had invaded and conquered Saxony, compelled her to listen to the remonstrances of her allies. Peace was concluded at Dresden, 25th December, 1745. Saxony paid a subsidy to Prussia, and Austria confirmed the cession of Silesia, which was guaranteed by Great Britain. Frederick acknowledged Francis I., the husband of Maria Theresa, as emperor. Frederick acquired East Friesland by the death of the last prince in 1744. The war of Succession was continued by France till the conclusion of the Treaty of Aix-la-Chapelle, October 18, 1748. It was followed by the Seven Years' war, upon which the military fame of Frederick mainly rests. The Treaty of Dresden had aroused in the mind of Maria Theresa a feeling of resentment against Great Britain. The steady support which that power had lent her in the defence of her throne was dearly purchased in her eyes by

the constraint which had been put on her in regard to the surrender of Silesia. Her minister, Count Kaunitz, had formed the scheme of uniting France and Austria, the opposing principals in the late war against Prussia. War was pending on an American question between France and England. Russia was courted by both sides, and the Empress Elizabeth made an alliance with Great Britain for the purpose of receiving one of the liberal subsidies which it had become the custom of that power to grant to her allies, but with the intention of turning against her when the war began. A secret alliance was already in existence between Russia and Austria, providing in the event of any aggressive movement on the part of Prussia against either for the revival of the Austrian claim on Silesia. Prussia was in the meantime prospering through the interval of peace, and Frederick was desirous to maintain it. He also was solicited by both France and England. Not suspecting the possibility of an alliance between Austria and France, and being treated with too little ceremony by the latter, he chose the English alliance. His treaty of neutrality with England (16th January, 1756) enabled Kaunitz to press with more effect his alliance upon the French court. Among other extensive projects his scheme embraced the partition of Prussia. Austria was to have Silesia and Glatz; Russia, Courland; Poland, Prussia; Saxony, Magdeburg; and Sweden, Pomerania. France concluded a treaty of neutrality and mutual guarantees with Austria in May, 1756. Before the schemes of his adversaries were matured Frederick resolved to anticipate them. He wrote to George II.: 'It is better to anticipate than to be anticipated.' In August, 1756, he invaded Saxony, entered Dresden on 7th September, and published the despatches which proved the existence of the scheme to partition Prussia. England now openly entered into a defensive alliance with Frederick, and subsidized him. The allies, whose plans had been discovered, Austria and the empire, France, Russia, and Sweden prepared for immediate hostilities. The Diet, on the complaint of the Elector of Saxony, declared Frederick guilty of a breach of the Landfriede, or peace of the empire, and granted a threefold contingent of troops against him, but the Northern States protested against the decision, and hired their troops to England for the assistance of Prussia. The general course of events of this war will be more fully noticed in an article on the SEVEN YEARS' WAR. The immense forces which his enemies were able to bring into the field reduced Frederick to the greatest straits, and gave opportunity for the development of the high qualities of strategic genius, moral firmness, and patriotic devotion, which have placed his name among the world's heroes. Towards the close of the war the English cabinet began to draw off from the Prussian alliance, but the death of the Empress Elizabeth, January 5, 1762, broke up the alliance against Prussia, and the Peace of Hubertsburg, 15th February, 1763, confirmed the Treaty of Berlin. According to Frederick's calculation 886,000 men had perished in a war which failed in effecting any territorial change. Its moral result was that Prussia was now regarded as one of the great powers of Europe. The Seven Years' war was certainly brought upon Prussia by the conduct of Frederick himself at the beginning of his reign, which had aroused the resentment of Maria Theresa; but the danger being averted, it was now to be seen what impression had been made on Frederick by the lesson he had received against encouraging aggressive designs. During the war Frederick had declared that the independence of the Polish Republic depended on the power of the House of Brandenburg. Catharine II. had now formed the scheme of partitioning Poland and invited the co-operation of Frederick. The Poles, on the other hand, were willing to elect a sovereign from his house. But Frederick could not afford to encounter the hostility of Russia, he therefore entered into a treaty with Catharine II., April, 1764, for regulating the affairs of Poland, and placing Stanislaus Poniatowski on the throne, which was effected by Russian and Prussian arms. The rapid advance of Russia in her war with the Turks subsequently aroused the jealousy of Prussia as of other powers, and brought Frederick into conference with the Emperor Joseph II. Two interviews took place at Neisse, in Silesia, in August, 1769, and Neustadt, in Moravia, in September, 1770, and it seems probable, although authorities differ on the subject, that the terms of the partition of Poland were discussed at these interviews. Immediately after the last of them some districts of Poland, of which Austrian troops had already taken possession, were declared reunited to the Kingdom of Hungary. About the same time the Prussians, on a frivolous pretext, violated the boundaries, and invaded the territories of the republic. Negotiations were then entered into with Russia on the double subject of peace with Turkey and the partition of Poland. The intrigues of the various powers engaged in this transaction belong more properly to the history of Poland. Russia and Prussia made a separate treaty, 17th February, 1772, and on 5th August, 1772, the terms of the partition were arranged in a triple treaty between the three powers. Prussia obtained all Pomerania, except Danzig and its territory, and a portion of Great Poland extending from the New March to Fordon and Solitz on the Vistula, and to the river Netze, together with the greater part of Western or Polish Prussia. The union of West Prussia with the kingdom was of the greatest importance, as it had hitherto broken the communication between the possessions of the new monarchy in a most awkward way. The Bavarian succession, thrown open by the extinction of the direct line, induced a war between Austria and Prussia in 1778 and 1779. In the negotiations for the settlement of this question at Teschen, 13th May, 1779, the annexation of Ansbach and Baireuth to Prussia, on the extinction of the direct line, was provided for. A league called the Fürstenbund was formed by Frederick to uphold the terms of the Peace of Teschen, into which George III. entered as Elector of Hanover. Frederick died 17th August, 1786. The latter part of his reign had been on the whole one of peace and of great growth and prosperity on the part of Prussia. For his private character see the biographical notice under his name. The early dangers of his reign had led to one peculiarity in his views, which tended to retard the development of the country's resources. He had an aversion to good roads as a means of opening up the country to an enemy. His other economical projects were such as in the opinion of the day were best adapted for promoting the industrial prosperity of the kingdom. In religion he established complete toleration, being indifferent to the opinions held by his subjects regarding it. The Landrecht, or Prussian code of laws, though not published during the reign of Frederick, was prepared by his chancellor, Count Karmer.

Frederick was succeeded by his nephew Frederick William II. In 1787 he reinstated the Prince of Orange, by an armed intervention, in the stadtholdership of Holland, and in 1788 concluded a defensive alliance with England and Holland, known as the Triple Alliance. The commencement of Frederick William's reign had been hailed by his subjects in hope of some relaxation of the despotism of their

princes, but these hopes were doomed to disappointment. The Religionsedict and the Censuredict, issued in 1788, showed that intolerance was again to prevail in matters in which it had been relaxed. The affairs of Turkey occasioned serious differences between Austria and Prussia, which on the accession of Leopold I. had nearly resulted in war, but were peaceably arranged by the Convention of Reichenbach, August 5, 1790. All eyes were now turned on the progress of the French revolution. Frederick William especially exerted himself in the cause of Louis XVI., and on 27th August, 1791, he issued, in conjunction with the emperor, the famous declaration of Pilnitz, summoning the European powers to his aid. The principalities of Ansbach and Baireuth were, towards the close of this year, incorporated with Prussia, being ceded to the crown by the margrave. In 1792, war having already been declared by the French authorities against the empire, the Prussians, under the Duke of Brunswick, invaded France. They were defeated by Kellerman at Valmy on 20th September. Jealousy of Austria, and disagreements with that power about the affairs of Bavaria and Poland, soon induced Frederick William to withdraw from active co-operation in the war of which he had been the prime mover, notwithstanding that he had just concluded a treaty with England for the prosecution of the war. What remained of Poland after the last partition had fallen almost completely under Russian influence. The attempts of a patriotic party in Poland to throw off the yoke formed the pretext of a new partition. An understanding was come to by the partitioning powers on 4th January, 1793, and twelve days after a Prussian army entered Great Poland. A declaration, charging the inhabitants of Danzig with holding revolutionary opinions and entertaining unfriendly feelings to Poland followed (24th February). The city was blockaded and taken, 8th April. A proclamation or patent was also issued on 25th March to the inhabitants of the Palatinates of Posen, Gnesen, Kalisz, Sieradz, Lentschitz, Rava, Plotzk, and some other districts, including the towns of Danzig and Thorn, that they were henceforth to consider themselves as Prussian subjects. By the Treaty of Grodno, signed 25th September, 1793, the Republic of Poland ceded the provinces already seized to Prussia. The third partition of Poland, 25th November, 1795, followed the suppression of the insurrection headed by Kosciusko. Prussia obtained the portions of the Palatinates of Rava and Plotzk not previously occupied, parts of Masovia, Podlachia, Troke, and Cracovia, including Warsaw. This distribution was modified subsequently through the Napoleonic wars. On 25th April, 1795, Frederick William entirely abandoned the coalition, and signed the Peace of Basel with the French Republic. By this treaty Prussia offered herself as mediator for the princes of the empire, thus encroaching on the privileges assigned by the German constitution to the emperor. A line of neutrality which should save North Germany from invasion was stipulated for. In the crisis of the eventful campaign of 1796 this treacherous policy was carried still further. A new line of neutrality was formed, and the states included in it were induced to withdraw their support from the imperial armies, while by a secret treaty Frederick William agreed to allow the French to advance their frontier to the Rhine, compensation for himself and other secular princes being provided by the secularization of ecclesiastical domains in Germany. Thus was anticipated the policy of Napoleon in forming the Confederation of the Rhine. By this treaty Saxony, among other powers, was induced to withdraw her support from the empire. Frederick William, worn out with debauchery, died on 16th November of the year (1797) following these disgraceful transactions. His successor, Frederick William III., retained the principal advisers of his father, but one of his first acts was to repeal the intolerant edicts passed in the late reign. He continued his father's policy in regard to France, and courted the French directorate, who showed more deference to their open enemy Austria than to their truckling ally; but when the Peace of Lunéville (1801) extended the French territory to the Rhine, Prussia was indemnified by 4116 square miles ceded to her at the expense of the empire. In 1804 Prussia recognized Napoleon as emperor of France, the Emperor of Germany taking at the same time the title of Emperor of Austria. During the same year Frederick William attempted to negotiate between France and Russia, and he remained neutral in the campaign which ended in the overthrow of Austria at Austerlitz, December, 1805. Napoleon had, however, in 1804, offended his pride by marching his troops, in spite of remonstrance, against the Austrians through the Prussian territory of Ansbach and Baireuth. He was preparing to join the allies when the victory of Napoleon anticipated him. The conqueror now compelled him to accept of Hanover in exchange for Ansbach, Baireuth, Cleves, and Neufchâtel ceded to France and Bavaria. Frederick William now occupied Hanover, which by a patent he declared annexed to Prussia in virtue of cession by the Emperor of France, to whom it belonged by right of conquest. This step embroiled him in war with Great Britain and Sweden. The tactics of Prussia were now turned against herself, and by the formation of the Confederation of the Rhine, which led to the dissolution of the empire, Prussia also was isolated in Germany. Napoleon indeed suggested to Frederick William the formation of a rival association, and even offered to support him in assuming the imperial crown; but he thwarted his efforts to form the new alliance, and threatened the princes who were solicited to join it. A still more flagrant expression of contempt filled up the measure of the endurance of the Prussian court. In his negotiations for peace with England Napoleon offered to restore Hanover. In the blindness of the indignation excited by this insult all considerations of prudence were forgotten, and Prussia, which had hesitated to encounter France with England and Austria as allies, now resolved to rush upon the danger alone. Her previous tergiversations, in fact, deprived her of the hope of allies among her German neighbours, and it is known that Napoleon, seeing her isolation, had deliberately provoked her to her overthrow. The Prussian army was immediately placed on a war footing. Peace was made with Sweden, and negotiations opened with England, but the disposal of Hanover was delayed till the result of the campaign should show whether Prussia was strong enough to contend single-handed with France. If she proved strong it was to be kept; if weak, it was to be exchanged for English subsidies. The Prussian army amounted to 180,000 men. It had the prestige inherited from the wars of Frederick II., and was commanded by the Duke of Brunswick, whose reputation dated from the Seven Years' war; but it had seen little service, and had to cope with the veterans of Marengo and Austerlitz led by Napoleon in person. The French emperor too, aided by the contingents of the Confederation of the Rhine, was able to bring a numerical superiority of force into the field. The Emperor of Russia had promised his aid to Prussia, but it could not arrive in time. Still the Prussians were sanguine and enthusiastic. The war party was headed by the youthful queen, who inspired the troops with a chivalric devotion. But

the single battle of Jena (Jena and Auerstädt, fought the same day, 14th October, 1806, may be regarded as one battle) dashed these delusive hopes, and laid the country prostrate at the feet of the conqueror. Before deciding the fate of Prussia Napoleon pushed on to meet the advancing Russians, and it was only at the Peace of Tilsit, concluded between him and the Emperor Alexander in June, 1807 (signed 7th–9th July) that he condescended to make known his terms to his former ally. Prussia was dismembered, and was spared as a kingdom only at the intercession of the Russian emperor. Her possessions west of the Elbe, including Hanover, had to be ceded to the Kingdom of Westphalia, formed for Jerome Bonaparte. The Grand-duchy of Warsaw, and the circle of Kotbus in Lusatia, were transferred to Saxony, which was raised to a kingdom. Danzig was restored to independence, or rather to dependence on France. East Prussia was assigned to Russia. All that was left to Prussia of her Polish acquisitions was Ermeland and part of the district of Netze. A war indemnity of 140,000,000 francs was imposed on the mutilated kingdom, and the fortresses of Glogau, Küstrin, and Stettin were to be delivered over to French garrisons maintained at the expense of Prussia as security for its payment. Frederick William was further obliged to engage not to keep on foot an army of more than 42,000 regular troops during the next ten years. The ports of Prussia were closed against England.

These measures would seem, as far as human prudence could foresee, to be the most effectual that could be devised for the humiliation of a kingdom. In the event they proved that, however often coercion may succeed, it can never safely be relied on. The history of Austria presents more frequent instances of recovery from disaster than that of Prussia. We have now reached the second instance in Prussian history, and it is one which, taken in its entire magnitude, is perhaps unparalleled in the history of the world. The hopes of the Prussians, even when the blow was recent, were not crushed by disaster; and the anticipation which Blücher, after the battle of Jena, expressed in his professional metaphor, 'that now more enlightened principles would put their foot into the stirrup,' did not prove a vain one. The very measure which seemed most effectually to bar the recovery of Prussia, the restriction of her army till her lost possessions should accustom themselves to new masters, was the means of making her the greatest military power in Europe. Baron Stein, to whom the administration of the kingdom was committed, began to prepare it for meeting foreign exactions by internal improvements. The national crisis was taken advantage of to sweep away obstructions which would otherwise have long resisted the hand of the reformer. Feudal usages were abolished, and the sale and transfer of land made entirely free. Local self-government was accorded to the towns, and ancient restrictions on trade were swept away. The offices of state were likewise reformed, and adapted to practical requirements. In the midst of these reforms the jealousy of Napoleon compelled Baron Stein to resign his post (November, 1808). His work was carried on by Baron Hardenberg. A plan of evading the army restriction was formed by General Scharnhorst. Young men entered the army, and after acquiring the necessary drill returned into private life, leaving their places vacant for others. This operation was conducted so quietly that it came to light only in 1813. Such was the germ of the Prussian Landwehr. During the Russian campaign of 1812, Prussia, like other German states, was compelled to follow in the train of the military despot, who at this time commanded the resources of nearly all Europe. In spite of the most obsequious behaviour she was still treated as a conquered enemy, and military exactions were freely made on her territory. A treaty was concluded, 12th February, 1812, by which Prussia engaged to support France with her arms, and was promised, in event of success, an addition of territory. When the disastrous termination of the Russian campaign was reached, it was the Prussian general York who, by the Convention of Tauroggen, concluded 20th December, 1812, with the Russian general Diebitsch, set the example of defection to the Germans. On 3d February the king issued a general call to arms, and 150,000 men were found to be at once disposable. A treaty with Russia was concluded on 27th February. Prussia undertook to provide 80,000 men for the war, exclusive of garrisons; and Russia engaged for the restoration of all the dominions of Prussia except Hanover. To the Prussian declaration of war the French minister replied by a history of the Prussian perfidies from the time of the revolution. The document was keen, but ill-timed, and little calculated to diminish the hostility of Prussia, which on the part of France had not been without provocation. Of the succeeding campaign, in which Europe was leagued against the oppressor, the particulars for which we have space have been given in the history of France. The names of Blücher, York, Gneisenau, and Bülow will recall the part taken in it by Prussia. Frederick William III. in person was present at Lützen and Leipzig. At the Congress of Vienna Hanover returned to England. Prussia demanded the whole of Saxony in compensation for the Duchy of Warsaw, on the plea that Saxony had been most opposed to the general cause. This demand was opposed by Austria, France, and England, and nearly led to a renewal of war. The congress was disturbed by the return of Napoleon, and in the campaign of 1815 Prussia, along with England, bore the brunt of the fight at Ligny and Waterloo. On the resumption of the congress Prussia received nearly the same territories as she possessed up till her recent acquisitions in the wars yet to be noticed.

After the restoration Frederick William III. leaned to the despotic councils of Austria and Russia, and did not carry out the reforming policy of his councillors in difficulty, Stein and Hardenberg. He joined the Holy Alliance, September 26, 1815, and continued a stanch adherent of it till death. The administration of affairs, though despotic, was vigorous, and on the whole successful. Compulsory education was made a fundamental principle of the state in 1816. Normal schools and gymnasia were endowed. A liberal mercantile tariff was established in 1818, but was afterwards superseded by the protective policy of the Zollverein. An attempt to heal the divisions of the Protestant church was begun in 1817. On the 31st of October the king, who was a Calvinist, took the communion in the Lutheran Church, and the term Evangelical was henceforward used officially in place of the party designations. Measures of coercion were, however, used to bring about the agreement which frustrated their own end. By a concordat with the pope in 1821 a Roman Catholic hierarchy, headed by two archbishops and six bishops, was established and provided with a fixed endowment from the state. Frederick William died 7th June, 1840. He was succeeded by Frederick William IV. As crown prince a sentimental admirer of English institutions, the new king was expected to grant a constitution to his subjects, but he refused the demand of his states to this effect in 1841. In 1847 he took the cautious step of summoning a combined meeting of provincial parliaments at Berlin, but he conferred on them no real power. When the first shock of the French

revolution was felt it appeared as if Prussian patriotism and loyalty would alone be evoked by it. But it soon became manifest that a wide diversity of interests existed, and that a spirit of alienation and hostility had sprung up between class and class. The country had been increasing rapidly in wealth and prosperity; roads and railways had been constructed, and navigation developed. But the extremes which mercantile prosperity induces had attended its progress. When the dread of French invasion had subsided the crowned heads of Germany, who since 1815 had reigned with a bigoted devotion to the principles of divine right embodied in the Holy Alliance, began to feel their thrones tremble beneath them. The smaller states began to secure themselves by according the reforms demanded by the middle classes. The danger anticipated from France had at the same time awakened a desire for the revival of German unity, and Prussia was looked to to lead in this movement. Delegates from all the minor states waited at Berlin in March to urge the granting of a constitution and the formation of a defensive league with the other states, when the news of the fall of Prince Metternich at Vienna determined the king to yield. But it was too late, insurrection had already begun (18th). It was crowned with success, after a bloody struggle. The king dismissed his ministers, and granted a liberal constitution. The Poles at the same time revolted against Prussia, which had violated her engagement at the Congress of Vienna to govern them as an independent state. They were put down by force at Posen in April and May, 1848. A national assembly met on 22d May, but it proved turbulent and incapable, and its deliberations were influenced by the mobs which continued the work of agitation in the capital. Matters were continually growing worse until on 5th December the king dissolved the assembly in a proclamation granting a constitution, which formed the basis of that which at present exists. A new parliament was assembled, by which its details were elaborated. (See the preceding section—Constitution and Government.) In the meantime two opposite movements for union were agitating Germany. The proletariat contemplated the overthrow of thrones and the formation of a general republic. The conservative unionists wished to re-establish a federal union more or less analogous to the old German Empire. With this last party the purely Germanic character of Prussia had great weight as compared with the composite character of the Austrian Empire, and when a representative assembly of the different states met at Frankfort it concluded its conferences on the headship of the empire by offering a hereditary crown to the King of Prussia. But the Frankfort assembly had not succeeded in inspiring respect sufficient to make its offer valid. The alarms which had induced the princes to send their deputies to the assembly in 1848 had begun to subside, and when the German Pharaohs saw that there was respite they hardened their hearts, dismissed their liberal ministers, and began to govern according to the principles of the Holy Alliance. The King of Prussia declined the proffered crown, and he as well as the Emperor of Austria withdrew their deputies from the assembly. Among the affairs taken cognizance of by the Frankfort assembly was a revolt of the Duchies of Schleswig and Holstein against Denmark, which was alleged to have violated their constitutional privileges as German states. The King of Prussia intervened in this quarrel at the instance of the Germanic Confederation in 1848–49. After some severe fighting a treaty of peace was concluded on 2d July, 1850, by which the right of Denmark to the duchies was acknowledged, while Holstein was recognized as a member of the Germanic Bund or Confederation. The duchies revolted against this settlement, and the matter was referred, at the instance of the Emperor Nicholas, to the great powers. By the Treaty of London, 8th May, 1852, to which England, France, Austria, Russia, and Prussia were parties, the Duke of Augustenburg having relinquished, on satisfaction, his claim to the duchies, Prince Christian of Schleswig-Holstein, afterwards Christian IX. of Denmark, was recognized as heir to the Danish crown, the integrity of the Danish monarchy was recognized, but the rights of the Germanic Confederation over Holstein and Lauenburg as members of the Bund were reserved. The breaking up of the assembly at Frankfort was followed by various intrigues on the part of Prussia and Austria to gain the ascendency in the Germanic Confederation, which ended in reducing the Bund, which had existed without power since 1815, to its previous state of impotence. (See GERMANY—History.) Prussia remained neutral during the Crimean war, but was one of the signatories of the Treaty of Paris, 30th March, 1856. In 1857 Prussia lost Neufchâtel, which had voluntarily joined the Swiss Confederation in 1848, and was, through the intervention of the great powers (treaty signed at Paris 26th May, 1857), permitted to retain its new allegiance. In the autumn of this year the king was seized with apoplexy, and the government devolved on his brother William, who was named regent in October, 1858. Frederick William died 21st January, 1861, and was succeeded by his brother William. The new king showed a disposition to absolutism, which gave his people considerable uneasiness. In 1862 Prussia, as head of the Zollverein, concluded a liberal commercial treaty with France. In 1862 and 1863 a lengthened dispute occurred between the chambers and the ministry under the direction of Count Bismarck. The king, who took the part of the latter, denied, through his minister, the right of the people to control the financial expenditure through their representatives. On the complaint of the Federal Diet that Denmark had not observed the Treaty of 1852, Austria and Prussia resolved to set that treaty aside, and the Prussians, under General Wrangel, entered Schleswig on 31st January, 1864. The other powers which had been parties to the treaty did not intervene, and Denmark was overpowered. By the Treaty of Vienna, signed Oct. 30, 1864, Denmark gave up Schleswig, Holstein, part of Jutland, and Lauenburg. Differences having arisen between the two powers as to the administration of the conquered provinces, a convention was signed at Gastein, 14th August, 1865. Prussia purchased the claims of Austria over the Duchy of Lauenburg for 2,500,000 Danish dollars, and it was agreed that Schleswig and Holstein should be administered separately by Prussia and Austria respectively, without prejudice to the rights of either party. In a despatch to the British diplomatic agents abroad Earl Russell expressed his regret that all rights, whether old or new, had been trodden under foot, and violence and conquest had been made the only bases on which the dividing powers had established this convention. Differences as to the final disposal of the duchies were not allayed by the convention, but became more irreconcilable. Prussia, which had determined on appropriating them, wished to buy out Austria, but the latter would not cede her claims for money. In support of the policy of appropriation the Prussian lawyers held that the claims of the Duke of Augustenburg had been deferred by the Treaty of 1852 to those of the King of Denmark, and that the latter, in whom the sole sovereignty of the duchies resided, had ceded them by the Treaty of 1864 to the two powers. The claims of Prussia were thus unblushingly rested on conquest. Austria supported

the claim of the Duke of Augustenburg, the son of the duke who had made the cession of 1852; and the Frankfort diet, which had proclaimed the right of the duchies to dispose of themselves, finally decided in favour of Austria. In view of a quarrel, which Count Bismarck had already determined to force upon Austria, a secret treaty had been made with Italy (formally acknowledged 27th March), which by her aggressive preparations had compelled Austria to increase her armaments. This increase was complained of by Prussia, and a circular was addressed (24th March, 1866) to the minor states demanding a decision as to their conduct in the event of Prussia being attacked by Austria. Seventeen of the states seceded from the Bund and sided with Prussia; others referred to the eleventh article of the Act of Federation, which prohibited war between the members of the Bund, and provided for the pacific settlement of their differences. On the 5th of May the Diet of Frankfort summoned Prussia, in accordance with this article, to give a formal declaration that her intentions were peaceful. General Gablenz, the Austrian governor of Holstein, having summoned a meeting of the estates for 11th June, Prussia declared the Convention of Gastein violated. The Prussian troops in Schleswig crossed the frontier on the 8th and dispersed the meeting held on the 11th. The Austrians having evacuated Holstein, General Manteuffel, the Prussian governor of Schleswig, proclaimed the provisional government established in Holstein since September, 1865, abolished, and appointed a president for the administration of the affairs of both duchies. Austria protested and demanded of the diet the mobilization of the Federal army. On the 11th the diet, by a majority of votes, declared that Prussia had broken the treaty, and on the 14th ordered the mobilization of the army. The same day the Prussian representative declared the confederation at an end, and withdrew from the diet. The following day (15th June) the Prussian troops entered Saxony and Hanover. The brief campaign which ensued is known as the Seven Weeks' war. Before entering on it the Emperor of Austria issued a war manifesto to his people, in which he solemnly protested against the unscrupulous ambition of Prussia. The Prussian forces were divided into three main armies; the first, under Prince Frederick Charles, occupied Saxony; the second, under the crown prince, advanced to the frontier of Silesia; and the third, called the army of the Elbe, operated on the right of the first. The whole movements were directed by the chief of the staff, Count von Moltke. The Austrians were commanded by Count Benedek, who distributed his forces along the Saxon and Silesian frontiers of Bohemia and Moravia. The Prussian troops had been recently armed with a new weapon, the needle-gun (Zündnadelgewehr). They were better led and commanded than the Austrians, but their decisive success was chiefly due to this deadly weapon. It had been used for the first time in the last Danish war. On 23d June the first Prussian army crossed the Bohemian frontier, and next day occupied Reichenberg. On the 28th a severe struggle took place with the Austrians and Saxons at Münchengrätz, after which the Austrians retired to Gitschin. In the meantime the crown prince was advancing from Silesia through the passes of the Sudetian Mountains. His troops entered the Austrian territory on the 22d at Reinerz and Landshut, from which they advanced to Nachod and Trautenau. After some fighting on the 27th and 28th, in which the Austrians sustained considerable losses, they advanced on the 29th, still fighting, to Skalitz. On the 30th the crown prince effected a junction with Prince Frederick Charles. The third army had also crossed from Saxony into Bohemia, and after an encounter with the enemy at Hunerwasser, near Turnau, had joined the first army. Gitschin was taken by Prince Frederick Charles on the 29th, and General Benedek fell back on Königgrätz. Here was fought on 3d July the decisive battle of Sadowa, so called from a village near Königgrätz where the chief attack of the Prussians was made. The Austrians, after an obstinate resistance, were completely defeated, the decisive point of the combat being the advance of the crown prince, whose army formed the left wing of the Prussians, on their right, just as they had succeeded in checking the attack of the Prussian right and centre upon this position. In consequence of this reverse the Emperor of Austria ceded Venetia to France with a view to relieve himself of the Italian war, and the Emperor of the French telegraphed to the King of Prussia offering his mediation. Eventually a treaty of peace was signed at Prague on 23d August. The Emperor of Austria agreed to the union of the Lombardo-Venetian Kingdom with the Kingdom of Italy, the debt charged on the Lombardo-Venetian Kingdom by the Treaty of Zürich being taken over by Italy. The emperor recognized the dissolution of the German Bund, and consented to a new formation of Germany in which the imperial state of Austria should take no part. He agreed to recognize a northern confederacy to be established by Prussia north of the Main, and to permit the states south of the Main to form a union, between which and the northern confederacy the terms of agreement were afterwards to be determined. He transferred to the King of Prussia the rights he had acquired in the Duchies of Schleswig and Holstein by the Vienna Treaty of Oct. 30, 1864, with the understanding that the people of North Schleswig, if they expressed their wish by a free vote to be united to Denmark should be ceded to that kingdom. The Emperor of Austria agreed to recognize territorial changes about to be made by the King of Prussia in North Germany, but at his request the King of Prussia agreed to leave the Kingdom of Saxony intact: the war contribution of Saxony and its position in the North German Confederation were to be left to the decision of Prussia. After deductions, on account of the share of Schleswig Holstein and the maintenance of the Prussian army of occupation up till the conclusion of the peace, the war contribution of Austria was fixed at 20,000,000 Prussian dollars. All treaties between the parties not invalidated by the dissolution of the Bund were to continue in force, but the coinage and commercial treaties to be revised. A subordinate campaign against Hanover, Bavaria, and other minor states included in the confederation, had been conducted by the Prussians with complete success. After the war Prussia incorporated Hanover, Hesse-Cassel, Nassau, Hesse-Homburg, Schleswig, Holstein, Lauenburg, Hesse-Darmstadt north of the Main, and the principality of Hohenzollern, which already belonged to the royal family. Thus was laid the basis of a strong German state, which, by the natural principle of absorption fostered by hereditary descent, offered the prospect of a solution of German unity by a process exactly the reverse of that to which the division of Germany into independent principalities was due.

On 16th July the King of Prussia invited the States of North Germany to form a new confederation. The terms on which the confederation was to be formed were communicated by Prussia to the different states on 4th August. They were an offensive and defensive alliance; mutual guarantee of integrity of dominions; a federal constitution, with a common parliament; the troops of all the states to be under the supreme command of the King of Prussia; the states to send plenipotentiaries to Berlin to draw up a constitution to be submitted to the

common parliament; the preliminary treaty to be valid for a year, unless superseded by a federal constitution. The treaty was signed by the different states between 18th August and 21st October, the last signature being that of Saxony. It was ultimately joined by the following states—Prussia, Saxony, Mecklenburg-Schwerin, Saxe-Weimar-Eisenach, Oldenburg, Saxe-Meiningen and Hildburghausen, Saxe Altenburg, Saxe-Coburg-Gotha, Anhalt, Schwarzburg-Rudolstadt, Schwarzburg-Sondershausen, Waldeck-Pyrmont, Reuss (elder and younger line), Schaumburg-Lippe, Lippe, Lübeck, Bremen, Hamburg, Hesse (for territory north of Main). The North German parliament met on 24th February, 1867. The constitution was formed on the basis of the Prussian proposals, the King of Prussia having, as president of the confederation, the right of representing it in diplomatic relations and of declaring war and peace. The parliament was dissolved by the king in person on 17th April. A reconstitution of the Zollverein was signed 8th July, 1867. The jealousy of France was strongly excited by the success of Prussia in the war and the formation of a powerful confederacy, which threatened to absorb the whole of Germany in an effective union, and the Emperor Napoleon took occasion to object to the Prussian garrison maintained since 1815 in Luxemburg, and entered into negotiations with the King of Holland to purchase that principality. This project was opposed by Prussia, and the relations of the two powers became so strained that war seemed imminent. In these circumstances a conference of the great powers took place in London from 7th to 11th May, 1867. The powers agreed to guarantee the neutrality of Luxemburg, the Prussian garrison was to be withdrawn and the fortress to be dismantled. These measures served to allay the agitation and remove the immediate danger of war.

The Spanish throne having become vacant through the expulsion of Queen Isabella, Prince Leopold of Hohenzollern consented, on the proposal of General Prim, to become a candidate for it. This afforded a new subject of jealousy to France, and after peremptory demands on the part of the French emperor not only that Prince Leopold's candidature should be withdrawn, which was done by himself personally, but that the King of Prussia, as head of the house, should pledge himself not to permit any future candidature of the same kind, war was declared by the Emperor of the French against Prussia on the 15th of July, 1870. The events of the war and the terms of the Peace of Versailles, 26th February, 1871, will be found in our article FRANCO-GERMAN WAR. On the invitation of the North German parliament, supported by the South German states, the King of Prussia assumed at Versailles on 18th January, 1871, the title of Emperor of Germany. (See GERMANY.) Prussia has since become the leading state of the new German Empire. Since the adoption by the Roman Catholic Church of the doctrine of Papal infallibility a severe conflict, known as the *kulturkampf* or battle of civilization, has been carried on by the government, supported by the majority of the chambers, against the Ultramontane party. In 1872 a School Inspection Bill was passed, intrusting the supervision of all educational institutions, public or private, to the state. In 1873 Dr. Falk, the minister of worship, brought in bills of ecclesiastical law, applying both to the Evangelical and Catholic Churches, putting the education of the clergy under strict control of the state, and limiting the right of the superior clergy to dismiss their subordinates. These bills were passed by the chambers, and after they had become law were carried out with great energy. The resistance of the clergy, and the interference of the pope, who issued an encyclical letter declaring the laws invalid, only led to the passing of still stronger measures. By one act passed in 1875, the payment of the state contribution to the revenues of the clergy was made conditional on their acknowledging the sovereignty of the state; by another, the articles of the constitution fixing the relations of the Roman Catholic Church to the state were modified; a third expelled Roman Catholic orders; and a fourth placed the management of the revenues of the Roman Catholic congregations in the hands of an elective body.

PRUSSIAN BLUE. See BLUE (PRUSSIAN).

PRUSSIC ACID, called also *hydrocyanic* or *cyanhydric acid* (HCN). This acid was discovered by Scheele in 1782, but first prepared in the pure state by Gay-Lussac in 1811. According to Hoefer (Histoire de Chimie) it was known to the Egyptian priests, who employed it for poisoning the initiated who had divulged the mysteries. Prussic acid is obtained by distilling with water the kernels of bitter almonds, peaches, apricots, plums, cherries, and quinces; the blossom of peaches, sloes, &c.; the leaves of the beech, cherry, laurel; and various parts of other plants. The acid does not exist ready formed, or only in very small quantity, in these substances, but is produced by a fermentative action (rendered possible by the water) of a substance called emulsin, upon the amygdaline of the plant, which results in the formation of glucose and hydrocyanic acid. Pure prussic acid is prepared by passing a stream of dry sulphuretted hydrogen over dry cyanide of mercury heated in a glass tube, which is connected with a well-cooled receiver. This process is extremely dangerous, as the vapour of the pure acid instantly produces death when inhaled.

An aqueous solution of prussic acid may be prepared by several processes. The following are commonly employed: (1.) Ten parts of ferrocyanide of potassium (yellow prussiate of potash) are heated in a retort with three or four parts of sulphuric acid, diluted with its own volume of water. The retort is provided with a receiver. The liquid which collects in the receiver contains hydrocyanic acid dissolved in water. In this process a constant stream of cold water must continue to circulate through the condensing apparatus; it is also advisable to put a little water into the receiver before beginning the process. (2.) Four parts of cyanide of potassium are placed in a well stoppered bottle, and a solution of 9 parts of tartaric acid in 60 parts of water is added. The bottle is shaken several times, and set aside in a cold place for twelve hours, at the expiry of which time the aqueous solution of hydrocyanic acid, containing about 3·5 per cent., may be poured off from the solid tartrate of potassium.

Pure anhydrous hydrocyanic acid is a colourless liquid, which solidifies at $-15°$ C. to feathery crystals. The specific gravity of the liquid is about 0·7; it boils at 26°·5; it dissolves in all proportions in water, forming a liquid which reddens litmus paper but slightly. The anhydrous acid burns with a very pale violet flame, producing water and carbon dioxide. One drop of the concentrated acid, or the inhalation of the smallest amount of the vapour of the same acid, causes instant death. When diluted largely with air and inhaled the vapour causes an irritation in the throat, giddiness, and headache. Although so very poisonous a substance, hydrocyanic acid is used to a considerable extent in medicine in dilute aqueous solution. The preparation of the pharmacopœia contains about 2 per cent. of true acid. Hydrocyanic acid quickly undergoes decomposition, giving off ammonia, and leaving a brown resinous substance. The aqueous solution likewise slowly decomposes, giving rise to the formation, among other products, of formate of ammonium. This decomposition takes place more quickly the more true acid the solution

contains; it is stopped to a great extent by the presence in the solution of a small quantity of a mineral acid. Alkalies aid the decomposition, exposure to light also quickens this action; hence solutions of this acid which it is required to keep constant should be very dilute, and should be preserved in bottles made of dark glass, kept in closed cupboards. As hydrocyanic acid is such a deadly poison, it is not unfrequently employed for criminal purposes. A ready and accurate method for its detection is therefore very necessary.

The presence of this acid in a liquid may be ascertained by the following tests:—

(1.) A little ferrous sulphate, which has undergone partial oxidation, is added to the suspected liquid, which is then rendered strongly alkaline with caustic soda or potash. If on now adding excess of hydrochloric acid a deep blue precipitate remains undissolved in the liquid, hydrocyanic acid was present in the original liquid.

(2.) A drop or two of the suspected liquid, acidified with a drop of hydrochloric acid, is placed in a small basin, over which is inverted another basin with a drop of yellow sulphide of ammonium on its inner or convex side. The lower basin is very gently warmed for a quarter of an hour or so; the upper basin is now removed, and very cautiously warmed until the yellow colour of the liquid contained in it has disappeared. When this liquid has become quite cold there is added to it one drop of a solution of ferric chloride; if a deep blood-red colour is produced, the original liquid contained the poisonous acid. These tests serve also to detect the presence of a cyanide. Should it be necessary to test the contents of a stomach for hydrocyanic acid, the matter must be mixed with tartaric acid to decidedly acid reaction, placed in a retort connected with a good condensing apparatus and receiver containing a little water, and heat applied. To the liquid which collects in the receiver the foregoing tests may be applied.

The salts produced by the replacement of the hydrogen in hydrocyanic acid by metals are called *cyanides*. Of these many are known. Cyanide of potassium is the most common; it is a white body, which may be produced by the direct combination of its elements; it is very poisonous. If cyanide of mercury be heated to low redness a gas is evolved, which burns with a violet flame. This gas is called *cyanogen*. Cyanogen is a gas at ordinary temperatures, having a pungent odour somewhat resembling that of hydrocyanic acid. It may be condensed to a liquid and frozen to a solid. It combines with many acids, also with the halogens, to form well-defined salts.

A series of salts is known which differs from the cyanides already mentioned in containing oxygen; they are called *cyanates*. *Cyanic acid* (HCNO) may be produced in many ways; thus if a solution of cyanide of potassium be submitted to electrolysis, cyanate of potassium is formed at the positive pole. The acid itself is a thin, colourless liquid, which reddens litmus strongly; it acts very quickly upon the skin, producing painful blisters.

In addition to the cyanides and cyanates there yet remains another series of salts connected with the acid under discussion which merits our attention. These salts are the *ferrocyanides* and the *ferricyanides*. The ferrocyanides have the general formula $M_4FeC_6N_6$ or M_4FeCy_6—Cy being the symbol often used to designate the compound radicle cyanogen. The ferricyanides have the general formula M_3FeCy_6—in each instance M denotes a monovalent metal.

Ferrocyanide of potassium, the most interesting of the ferrocyanides, has the formula K_4FeCy_6, and is generally known by the name of *yellow prussiate of potash*. It is prepared by heating together nitrogenous animal matter, such as hides, hoofs, skin, horns, old leather, &c., with pearl-ashes (carbonate of potassium) and iron-filings, lixiviating the fused mass with water, filtering, and evaporating.

The following table shows the amounts of nitrogen contained in different kinds of animal matter:—

100 parts of horn contain	.....	15 to 17	per cent. of nitrogen.
"	dried blood, ...	15 to 17	"
"	woollen rags, ...	10 to 16	"
"	sheep-shearings, ...	16 to 17	"
"	calves' hair, ...	15 to 17	"
"	bristles, ...	9 to 10	"
"	feathers, ...	17	"
"	hide clippings, ...	4 to 5	"
"	old shoes, ...	6 to 7	"
"	charcoal from horn,	2 to 7	"
"	charcoal from rags,	2 to 12	"

From 2 to 5 cwts. of pearl-ashes are melted in a suitable iron vessel, and when heated to bright redness, the animal matter, in the proportion of about 125 parts to every 100 parts of pearl-ash, is added, along with 6 to 8 per cent. of iron in the shape of filings or smithy scales. Combustible gases are evolved in large quantity, and the mass becomes pasty. Heating is continued, the mass in the vessels being stirred until the whole becomes nearly fluid. After one or two hours the semi-fluid substance is ladled out into small cast-iron dishes, where it is allowed to cool. During this process part of the carbon of the animal matter reacts upon the nitrogen to form cyanogen, while another part deoxidizes the pearl-ash, with the production of potassium, which then unites with the cyanogen to form potassium cyanide. The fused mass, or 'metal,' as it is technically called, is now broken into pieces, which are thrown into large iron pans, where they are digested in water as quickly as possible; the aqueous fluid is then run off into evaporating pans, where it is boiled down until it attains a gravity of 1·27, when it is run into crystallizing pans, in which a crude salt is deposited. During this operation the cyanide of potassium and the iron salts in the 'metal' are brought into closer contact, so that they react upon one another, the product of this reaction being ferrocyanide of potassium. It would not be possible for this action to take place at the high temperature of the melting-pots, because at that temperature ferrocyanide of potassium suffers decomposition. The crude salt obtained by the first crystallization is redissolved in water, and the solution run off from any sedimentary matter into cast-iron crystallizing vessels, where large crystals of pure ferrocyanide are gradually formed.

Ferrocyanide of potassium crystallizes with three molecules of water ($K_4FeCy_6 + 3H_2O$), in large, lemon-yellow, truncated pyramids belonging to the quadratic system. This salt is inodorous; it has a sweetish taste, a neutral reaction, and is not poisonous. By the action of oxidizing agents upon ferrocyanide of potassium one atom of potassium may be removed. A new salt having the formula K_3FeCy_6, and the name *ferricyanide of potassium*, or *red prussiate of potash*, is thus produced. Ferricyanide of potassium is usually prepared by passing chlorine either over dry powdered ferrocyanide or through a solution of the same salt in water. This salt forms large, blood-red, prismatic crystals, belonging to the monoclinic system. As oxidizing agents convert ferro- into ferricyanide, so, conversely, do reducing agents transform ferri- into ferrocyanide of potassium.

These two salts may be distinguished by their action on iron salts. Ferrocyanide gives a deep blue precipitate with proto-salts of iron, but not with per-salts. Ferricyanide gives a similar precipitate with per-salts only.

PRUTH, a river of Europe, which rises on the eastern side of the Carpathian Mountains, in the

south-east of Galicia; flows circuitously east past Czernowitz, then S.S.E., forming the boundary between Moldavia and the Russian government of Bessarabia, and after a course of more than 500 miles enters the Danube on the left, about 12 miles below Galacz. Its principal affluents are, on the right, the Czeremosz, Elan, and Kagarlui; and on the left the Tchugor, Beghirla, and Lapushna.

PRYNNE, WILLIAM, a learned lawyer and antiquary, was born at Swanswick, in Somersetshire, in 1600, and was placed at Oriel College, Oxford, where he graduated Bachelor of Arts in 1620. He then removed to Lincoln's Inn to study the law, and became barrister, bencher, and reader of that society. His attendance upon the lectures of Dr. Preston, a distinguished Puritan, strongly attached him to that sect, and he began to write as early as 1627, attacking the drinking of healths, love-locks, Popery, and Arminianism, which he deemed the enormities of the age. In 1632 he published his work against theatrical exhibitions, entitled Histrio-Mastix, which, although licensed by Archbishop Abbot's chaplain, yet, in consequence of some reflections upon female actors that were construed to be levelled at the queen (who had acted in a pastoral after the publication of the work), brought a prosecution upon the author in the Star-chamber, which condemned him to a fine of £5000, to be expelled the University of Oxford and Lincoln's Inn, to be degraded from his profession of the law, to stand twice in the pillory, losing an ear each time, and to remain a prisoner for life. Prynne continued writing against Prelacy in prison, until, for a virulent piece, entitled News from Ipswich, he was again sentenced by the Star-chamber in 1637 to a fine of £5000, to lose the remainder of his ears in the pillory, and to be branded in each cheek with the letters S. L. (seditious libeller). This sentence was also executed, and he was removed for imprisonment to Caernarvon Castle, and afterwards to the Island of Jersey. His spirit was not, however, to be subdued, and he continued to write until the meeting of Parliament in 1640, when, being chosen representative for Newport, in Cornwall, the House of Commons issued an order for his release. He entered London, with other sufferers, in triumphant procession, and petitioned the Commons for damages against his prosecutors. On the impeachment of Laud he was employed as chief manager of the prosecution, and when the Parliament became victorious was appointed in 1647 one of the visitors to the University of Oxford, where he laboured strenuously to advance the cause of Presbyterianism. He was also in 1647 appointed recorder of Bath. He warmly opposed the Independents when they acquired ascendency, and used all his influence to produce an accommodation with the king, being one of the members who were excluded and imprisoned on that account in 1650. With the other excluded members he resumed his seat in 1659, and displayed so much zeal for the Restoration that General Monk was obliged to check his impetuosity. He sat in the Healing Parliament (1660) as member for Bath, and on the Restoration was appointed to the office of chief keeper of the records in the Tower. He occupied his later years in writings connected with his office in the Tower, and finished his life at his chambers in Lincoln's Inn in 1669. Prynne was a man of extensive learning and indefatigable industry, but deficient in judgment. His works, of which Wood has given a catalogue, amount to forty volumes, folio and quarto, the most valuable of which is his Collection of Records (three vols. folio).

PRYTANEUM, the town-hall in a Greek state. It was looked on as the official home of the state, and was kept up like a private residence. At Athens foreign ambassadors and citizens returning from embassies were entertained there. There too the prytanes (those senators who presided in turn) held their meetings, and lived at the public expense during the thirty-five or thirty-six days of their presidency. The liberty of eating in the Prytaneum was one of the highest marks of honour, and was conferred only on those who had done important service to the state.

PRZEMYSL, a royal town of Austrian Galicia, on the river San, 51 miles west of Lemberg. It has two ancient cathedrals and several cloisters; a trade in wood, leather, and linen, and two corn-mills. Przemysl was founded in the eighth century by the Polish prince Przemyslaw, and called after his name. The ruins of the ancient residential castle are on a neighbouring hill. Pop. (1880), 22,373.

PSALMANAZAR, GEORGE, the assumed name of a man of letters, who is chiefly known as a literary impostor. He was born of Catholic parents, in the south of France, in 1679. His mother, being abandoned by her husband, sent her son to a school kept by Franciscan friars; and he was afterwards placed in a college of the Jesuits. He then studied among the Dominicans, and having finished his education acted as a private tutor. Leaving his situation, he engaged in several adventures; and at length having stolen from a church, where it had been dedicated, the habit of a pilgrim, he roved about in that character, subsisting on charity. He afterwards became a common vagrant, and then servant to the keeper of a tavern, whose house he left clandestinely, and, renewing his wandering mode of life, he conceived the project of professing himself to be a Japanese convert to Christianity, who had found his way to Europe. As he did not find this scheme very profitable, he adopted the character of a heathen native of the island of Formosa, and in order to support his pretensions he contrived a new language, which he called the Formosan. At this time he became acquainted with a clergyman named Innes, who, conceiving he could turn the imposture to good account, persuaded the pretended Formosan to suffer himself to be converted to the Church of England; and the clergyman and his new disciple went to London, where the latter was presented to Bishop Compton and others, and the former was rewarded for his zeal with church preferment. Psalmanazar had the effrontery to translate the Church Catechism into his newly-invented Formosan language; and he published a History of Formosa (1704), which passed through several editions. In the meantime he was sent to study at Oxford; and a controversy was carried on between his patrons and Dr. Halley, Dr. Mead, and some other less credulous persons, who refused to admit his pretensions. The imposture at length became clearly manifest; and the culprit, deserted by those whom he had deceived, was obliged to rely on the exercise of his literary abilities for his support. He settled in London, where he resided many years, and was employed by the booksellers, particularly about 1730, in the early part of the Universal History, published in 1747. Towards the close of his life he drew up an autobiographical Memoir, in which he expresses much contrition for the deceptions which he had allowed himself to practise. His death took place in 1763. Dr. Johnson, who in early life became acquainted with Psalmanazar, always spoke with high respect of his talents and acquirements. Among all the distinguished men he had ever met, he pronounced the impostor Psalmanazar to be the most universally learned and accomplished.

PSALMODY, the art of writing or composing divine hymns or songs. The use of psalmody was common in the early church, by which it appears to have been borrowed from the Jewish synagogue wor-

ship. The composition and performance of psalmody appears to have been practised and encouraged in Germany, France, and the Low Countries before it was introduced into Britain. Most of the old melodies now sung in the service of the parochial churches were set by German musicians. In France psalmody was popularized at the Reformation by Clement Marot and Claude Goudimel, the former of whom translated the Psalms of David in verse, while the latter set them to music. It does not, however, appear that psalm-singing at first gained admission into public worship; but it was a long time confined to family devotion, especially among the reformed. Luther, who was a good musician, is known to have regularly practised psalmody with his friends every evening after supper. The first English version of the Psalms of David, which appeared soon after that of the French, was made in the reign of Henry VIII., by Thomas Sternhold, groom of the robes to that monarch, and John Hopkins, a schoolmaster, assisted by William Whittyngham, an English divine of considerable learning. It was afterwards superseded by the version of Nahum Tate, the poet laureate, and Dr. Nicholas Brady. The early reformers of Scotland paid great attention to psalmody. In John Knox's Psalter the metrical Psalms were arranged for use in churches with four-part harmony. Sternhold and Hopkins' version of the Psalms was first used in Scotland, and was afterwards superseded by the version now in use, founded on that of Francis Rous, provost of Eton, a member of Cromwell's government. Among modern collections of psalmody we may mention that known as Hymns Ancient and Modern, extensively used in the Church of England.

PSALMS, Book of, one of the canonical books of the Old Testament, containing the liturgical collection of hymns used by the Jews in the temple service. The ancient designation of this book is unknown. The present Hebrew name is *tehillim*, praises. The Septuagint version calls it *psalma*, from which our word psalm is derived. Each psalm in the collection, with a few exceptions, has a particular superscription, and these are generally believed to be genuine. The titles of the psalms in these superscriptions are various; *tehillim* applies only to Psalm cxlv. Many of them are entitled simply prayers. *Maschil*, instruction, *michtam*, memorial, and numerous other titles are used. The chronology of the Psalms is much disputed. Psalm xc., composed by Moses, is generally supposed to be the oldest. Probably only a few of the others are older than the time of David, though there is evidence that older collections have been used by the first collectors. Some are as late as the return from the captivity; and some critics assign others to the age of the Maccabees. Hitzig, Lengerke, and Justus Olshausen assign the greater part of the Psalms to the Maccabean period. To this opinion there are insuperable objections. It is evident from history that the Maccabean age, notwithstanding the warlike patriotism displayed in it, was one of rapidly prevailing declension, in which the general spirit of the people was becoming secularized, and the imitation of their gentile neighbours was undermining their attachment to their ancient faith; while those who still clung to it developed a narrow and sterile bigotry, which grew into the endless and meaningless formalities of the Pharisees. It is not to such an age we should look for the noblest and purest aspirations of Hebrew devotion. There is an ancient division of the Psalms into five books, distinguished by the doxologies at the end of Psalms xli., lxxii., lxxxix., and cvi., which many critics look upon as indicating five distinct collections. Those who take this view place these collections in chronological order as they stand, and some of them consider the particular psalms in each collection as belonging to the period of the particular collection. The first two collections, according to them, contain all the Psalms of David. This view is evidently difficult or impossible to prove; for what is to hinder a later collector from introducing an earlier psalm which had been omitted from a previous collection? The suggestion that the psalms superscribed with the name of David in the later collections were written by descendants of David is more ingenious than plausible. The age of some of the psalms is indicated by allusions, of others by the language employed.

The rhythmical form of the Hebrew poetry is so completely lost that it has been doubted if it had any; but there is a poetical structure in the disposition of the matter more imperishable than mere form, and which even translation cannot destroy. The sentiments are arranged in pairs answering to each other, or each sentiment receives a double expression. This method of composition by strophe and antistrophe is the most universal characteristic of Hebrew poetry. Another characteristic frequently exemplified in the Psalms is the antiphonal structure. There is no doubt that many of the psalms are constructed to be sung in parts. It is evident from the treatment of the subject that in many of them a principal part is assigned to the officiating priest, and a subordinate or responsive one to the people. In others two choirs appear to respond to each other; or some principal personage other than the priest—the king or some successful warrior—takes the leading part. Some may have even a more complex dramatic character; but there is considerable difficulty in determining the extent to which this form of construction prevails in the Psalms, as well as in ascertaining the true form of particular psalms. It is hardly possible to tell how much of the conjectural restoration effected by critics is due to a true insight into the original nature of the composition, and how much is superadded by the plausible ingenuity of the critic. It is evident that almost any lively poem of a descriptive and narrative order would bear partial dramatizing, and the responsive structure of Hebrew poetry is habitual to the writers of poetry of every species, and is not in itself an evidence of a dramatic intention, although this form of composition naturally lends itself to responsive singing or recitation, and may either have originated it or have originated in it.

David, who arranged the temple music, not only appointed from the Levites a number of singers and musicians, but also composed for the divine worship sacred songs, which served as a model for many others. Several of the psalms that bear his name are not, indeed, written by him, but only composed in his manner, and therefore called by his name. Seventy-one, in particular, are ascribed to him, but some of these are evidently of a later date. On the other hand, the contents and style of some which do not bear his name, and the superscriptions of which have perhaps been lost, show him to have been the author. To his times belong most of the psalms attributed to Asaph, Heman, and Ethan or Jeduthun. Twelve psalms bear Asaph's name, of which several show traces of a later origin. Asaph, son of Berachiah, was a Levite, and (1 Chron. xvi. 5) the first of the chief musicians appointed by David for the divine worship. The name of Heman is attached to one only (Psalm lxxxviii.) Heman, surnamed the Ezrahite, seems to have been a Levite, and is named among the chief singers of David. Some of the psalms were composed by Solomon, who, according to the First Book of Kings (iv. 32) wrote a 'thousand and five songs,' but whose name is affixed, in our collection, to two only (Psalms lxxii. and cxxvii.), and of these the first seems rather to have been writ-

ten for Solomon than by him. But, on the other hand, some others, of unknown authors, may be his; several are at least of his time, and refer to events of his reign—the consecration of the temple, &c. The opinion that some psalms are of the time of Samuel, and written by the prophet himself, is supported by no historical testimony, but is not improbable. Most of those by unknown authors seem to be of later date; some few apparently belong to the reigns of the kings immediately succeeding Solomon, several to the mournful days of the Babylonish captivity and of the return, especially those headed 'for the sons of Korah,' most of which are probably by the same author. Of later date also are probably those called 'songs of the degrees,' which some have referred to the return from Babylon, others to the annual pilgrimages to Jerusalem and the temple, and which others suppose to have been sung on the steps of the temple. Our collection consists of 150 psalms, but the manuscripts are not all numbered alike. The Septuagint and Vulgate unite Psalms ix. and x., and civ. and cv., while they divide Psalms cxvi. and cxlvii. into two, so that their number differs in some respects from that of the English translation.

The Psalms are lyric poems, chiefly odes, and didactic, elegiac or idyllic. (See Lowth's Hebrew Poetry.) Most of them are in the form of prayer, or begin or end with prayer; and, whether they utter complaint, lamentation, or consolation, are expressive of the deepest trust in God. They are among the highest and sublimest efforts of poetry; and the holy light of revelation, the inspiring belief in the eternal true God, spreads over them a bright splendour, and fills them with deep fervour. They must not be compared with the other lyric productions of the ancient world; they are altogether the peculiar growth of the Holy Land, where the voice of revelation resounded most loudly, and was preserved the most purely. Many of their allusions are historical, and must be explained by history; but it would be going too far to attempt to explain everything historically; since it is evident that much is metaphorical, some, though a smaller portion, allegorical, and much prophetical, referring to the future rather than to the past. Some, on account of their local allusions, are less instructive to us; but most of them are rich in encouragement, consolation, filial trust, joyful confidence in God, evidences of humility and patience, and are well adapted for the sacred songs of Christians. It may be added that the collection in the Old Testament by no means contains the whole treasure of Hebrew psalms. Not only are most of Solomon's songs lost, but there are many others mentioned in the Old Testament which are not in our biblical collection.

PSALTER, a collection of the Psalms; also a large chaplet or rosary, consisting of 150 beads, the number of the Psalms in the Psalter.

PSALTERY, or PSALTERION, a stringed instrument much used by the ancient Hebrews, and by them called *nebel*. We know but little of the ancient form of this instrument, but have reason to conclude that it resembled that of our harp. The psaltery now in use is a flat instrument, in the form of a trapezium, or a triangle truncated at top. It is strung with thirteen wire cords, tuned in unisons or octaves, and mounted on two bridges. It is performed on a plectrum, whence it is usually ranked among the instruments of percussion.

PSAMMETICHUS, or PSAMMITICHUS, the Greek form of the Egyptian Psametik, a king of Egypt belonging to the seventh century B.C. His father was king of Sais, but was driven from the throne and slain by the Æthiopians, who held Egypt subject for fifty years during the latter part of the eighth and the beginning of the seventh century B.C. Psammetichus managed to escape to Syria, where he remained till the Æthiopians were expelled. On his return he was made one of the twelve kings who reigned simultaneously in Egypt for fifteen years after the expulsion of the Æthiopian dynasty; but being suspected by the other kings of aiming at sole sovereignty he was driven into banishment, when he took refuge in the marshy districts bordering on the sea. Here he succeeded in obtaining the support of some Ionic and Carian mercenaries, with whose aid he defeated the other kings in a battle fought at Momemphis, on the east side of Lake Mareotis, after which he actually became the sole king of Egypt (671 or 670 B.C.) He fixed his residence at Sais, and is hence mentioned as the founder of the Saitic dynasty. The Greek mercenaries, to whom he owed the throne, were rewarded with settlements on the eastern (Pelusiac) branch of the Nile. By the favour which he thus showed to foreign soldiers he greatly offended the military class in Egypt, a considerable number of whom migrated in consequence to Æthiopia. To protect himself against the enmity of this class he seems to have bound himself all the more closely to the priestly class, whom he gratified by the erection of religious edifices. The most important of these are southern propylæa of the temple of Phthah (identified by the Greeks with Hephaistos) at Memphis, and a splendid aula or court with a portico round it for the habitation of Apis, in front of the temple. He waged wars with Syria and Phœnicia, and took Azotus (Ashdod) after a siege of twenty-nine years. The class of interpreters owed its origin to his sending a number of Egyptian children to learn the Greek language among the Greeks, whom he had settled in the country. He died B.C. 617 or 616.

PSARA, or IPSARA (*Psyra*), an island of Turkey, in the Grecian Archipelago, 7 miles north-west of Scio, about 5½ miles in length, and as many in breadth. It consists almost entirely of a rock, thinly covered in some places with a vegetable mould.

PSEUDO, a Greek word synonymous with false, spurious, or lying, and often used in this sense as a prefix to other words in most modern languages. Thus we speak of a *pseudo-prophet*, a false or lying prophet; a *pseudo-philosopher*, a false or only would-be philosopher; &c. Sometimes too a work bearing a false name, or any other than that of the author, is said to be *pseudonymous*. In the same sense also we apply the term to individuals who have attempted to personify others by falsely assuming their name, and speak of a *pseudo-Demetrius*, a *pseudo-Sebastian*, or a *pseudo-Isidore*.

PSEUDOMORPH, a mineral which has the form, not of the substance of which it actually consists, but of some other substance which has wholly or partly disappeared.

PSKOV, a government of Russia, bounded north by St. Petersburg, north-east by Novgorod, east by Tver, south-east by Smolensk, south by Vitebsk, west by Livonia; area, 16,860 square miles. The surface towards the south-east is rather elevated, being traversed by the Valdaï Hills, but sinks gradually down near the centre, having only a gentle slope towards the north and west. Immense numbers of blocks of granite lie scattered in all quarters. The whole government belongs to the basin of the Baltic, the South Dwina, which drains the south-east, carrying its waters into the Gulf of Riga, and the Velikaia, Chelon, and Lovat, with other small tributaries, carrying the rest of the drainage into the Gulf of Finland. The soil is throughout of poor quality, and can only be made to yield tolerable crops by heavy manuring. Wheat is seldom grown, and the prin-

cipal crops are oats and barley, which are raised in considerable quantities, so as to leave a surplus for export. A considerable extent of ground is sown with hemp and flax. Forests also are extensive; but the wood is not of the best quality, and oak is seldom met with. Pine is very prevalent, and furnishes the means of manufacturing large quantities of pitch. The only other manufacture of importance is leather. Pskov is divided into eight districts. Pop. (1882), 890,944.

PSKOV, or PLESKOV, a town, Russia, capital of the above government, on the right bank of the Velikaia, which here receives the Pleskova, 165 miles S.S.W. of St. Petersburg. It is walled, flanked with towers, all in a very dilapidated state, as are also many of the houses. It consists of the Kremlin, the Central city, the Great city, and a considerable suburb. All the private houses and the far greater part of the public edifices are of wood. The finest buildings are in the Kremlin. Among others are the cathedral, of very little architectural merit, but gorgeously decorated; and the palace of the ancient princes of Pskov, now occupied by the archbishop. The number of churches amounts to thirty, but more than a third of them are in disuse. The principal manufacture is Russian leather; and there is a considerable trade in hemp, flax, tallow, hides, &c., with Narva and other seaports on the Gulf of Finland. Pskov is the see of an archbishop, and possesses a theological seminary, a Bible society, and a well-managed hospital. It is said to have been founded by the Princess Olga towards the end of the tenth century. Pop. 19,267.

PSOROSPERMIÆ. See PARASITES and PROTOZOA.

PSYCHE (Greek, the soul), a lovely maiden, celebrated on account of the beautiful story respecting her, in which she is to be considered an allegorical personification of the human soul. Apuleius makes her the daughter of a king, and relates her history thus: Psyche, whose two elder sisters were of moderate beauty, was so lovely that she was taken for Venus herself, and men dared only to adore her as a goddess, not to love her. This excited the jealousy of Venus, who, to revenge herself, ordered Cupid to inspire her with love for some contemptible wretch. But Cupid fell in love with her himself. Meanwhile her father, desiring to see his daughter married, consulted the oracle of Apollo, which commanded that Psyche should be conveyed with funeral rites to the summit of a mountain, and there be left, for she was destined to be the bride of a destructive monster in the form of a dragon, feared by gods and men. With sorrow was the oracle obeyed, and Psyche was left alone on the desert rock, when suddenly Zephyr hovers around her, gently raises and transports her to a beautiful palace of the god of love, who visits her every night unseen and unknown, leaving her again at the approach of day. Perfect happiness would have been the lot of Psyche, if, obedient to the warning of her lover, she had never been curious to know him better. But by the artifices of her jealous sisters, whom she had admitted to visit her contrary to the commands of Cupid, she was persuaded that she held a monster in her arms, and curiosity triumphed. As he slept she entered with a lamp to examine him, and discovered the most beautiful of the gods; in her joy and astonishment she let a drop of the heated oil fall upon his shoulders. Cupid awoke, and having reproached the astonished Psyche for her suspicions fled. After having tried in vain to throw herself into a river, she wandered inconsolable to all the temples, seeking everywhere her beloved, till she came to the temple of Venus. Here began her severest sufferings. Venus kept her near her person, treated her as a slave, and imposed upon her the severest and most trying tasks. Psyche would have sunk under the burden had not Cupid, who still tenderly loved her, secretly assisted her in her labours. But in the last dangerous task imposed upon her, to descend to the realm of shadows, and bring away Proserpine's box of cosmetics, she almost perished. She succeeded indeed in the adventure; but having opened the box a deadly vapour issued from it, and she sunk lifeless to the earth. Cupid now appeared, and the touch of his arrow restored her to life. Venus was finally reconciled; by Jupiter's command Psyche became immortal, and was for ever united with her beloved. Her marriage was celebrated with great festivities, and her envious sisters threw themselves from a precipice. Raphael has given a most beautiful representation of the marriage in the Farnesina at Rome.

PSYCHOLOGY (Greek, *psuche* or *psyche*, the soul, and *logos*, word, doctrine), that department of philosophy which has specially to do with the observation of the states and actions of the human mind. The division of philosophy into various branches is at once natural and convenient, but it is to be regretted that philosophers themselves do not always attend to the nature of the distinction on which such a division depends. There can be no absolute line drawn in philosophy between observation and reasoning. There cannot be one department of philosophy from which observation is excluded, and another from which reasoning is excluded. When we first enter on philosophical inquiry we are already in possession of a body of facts bearing on the subject of our investigation; but when we begin to reason in these facts we find them insufficient and unsatisfactory, because they have been collected without method or design. We have, therefore, to begin again to recollect our facts by a methodical process of inquiry specially directed to the solution of the questions which have suggested themselves to us in our preliminary reasoning, and as new questions arise in the course of our investigation new processes of inquiry have to be set on foot with a view to their elucidation. It is to this methodical process of investigating facts that the term psychology properly applies. There are stages of philosophical investigation in which we may engage in lengthened processes of reasoning and induction from facts already ascertained or assumed. These processes are commonly called metaphysical or ontological; but as the metaphysical processes are founded on observation, so the methodical processes of investigation implied in psychology are directed by reasoning, and as the observation of facts tends to the discovery of laws, which is itself a species of observation, psychology not only demands method but admits induction. The distinction between it and other more abstruse branches of philosophy is, therefore, one not of kind but of degree. Those philosophical processes which are mainly directed to observation, and immediate induction from observation, comprehending the distinction and classification of the various series of observed facts, that is, of mental states, processes, and powers, are properly called psychological; those processes which carry out to their completion the lines of reasoning already begun upon assumed facts, and which, by subjecting the facts to a more searching analysis, aim at acquiring a more exhaustive knowledge of them, and drawing from them more extended inferences, are properly called metaphysical or ontological. These processes, it is evident, mutually react upon each other, and the psychological process cannot be held to be complete till it has received the final revision of the metaphysical. Thus, Plato describes the method of philosophical investigation, which he calls

dialectical, as the process of ascending from particulars to generals, and of redescending from the general to the particular.

The complete method of philosophy is, however, subject to this drawback that the subject is inexhaustible, and that the reasonings to which philosophical facts give rise are endless. Hence the convenience of divisions and breaks in the processes of reasoning, that conclusions may be revised and facts reverified; but the nature of these divisions must be clearly understood, or they will inevitably promote error and confusion.

During the reign of the scholastic philosophy reasoning and distinction were carried to such an extent, and drawn out with such a multiplicity of subtleties and refinements, that the facts were overburdened, distorted, misrepresented, lost sight of, and contradicted till the very meaning of words became doubtful. In these circumstances Descartes recalled the attention of bewildered thinkers to the process of observation and re-established psychology. At present a somewhat different danger appears to attend philosophy, and its psychological groundwork, after being built over and buried, is now being undermined, and threatened with being swept away as an obstruction to a profounder science.

This danger proceeds from a school which, through some at least of its exponents, arrogates to itself exclusively the title of psychological, and repudiates, as a thing entirely apart from psychology, all connection with metaphysics. We have shown that even as a branch of philosophy psychology cannot be supposed altogether to exclude induction. Much more if psychology is erected into an independent science must induction be included in it. The definition of psychology then must be the observation of and induction from mental phenomena. What is this but a definition of philosophy? and what in this case is the meaning of the repudiation of metaphysics? It certainly does not mean that these psychologists wish to limit the range of induction from facts. This is an interpretation which they would by no means admit, and which, in fact, their own procedure shows that they do not acknowledge. There seems only one other admissible interpretation, that by metaphysics they mean induction which they do not like, and by psychology induction which they do like. It would be very rash to deny that much false induction has gone under the name of metaphysics, but it does not seem a very promising mode of escaping false induction to change the name of the process.

But the inconvenience of putting their metaphysics under the title of psychology, and thus destroying the distinction which the introduction of psychology as a branch of philosophy was intended to establish, is not the only charge against this school. It seems in danger by the undue prominence it gives to a particular class of questions of destroying another well understood distinction, that between physiology and psychology. The physico-psychological problem, to which the chief attention of this school is directed, belongs in its complete treatment neither to psychology nor to physiology, but to philosophy, which receives and combines the results of the several sciences, and the physiological part of this problem does not belong to psychology at all. That physiological and psychological phenomena are blended in fact, and that consequently no absolute dividing line can be drawn between them is true; but the reason of forming two sciences is that the phenomena as far as distinguishable may be studied apart. If, instead of occupying himself with what is clearly distinguishable in his own department, the psychologist bestows his whole attention upon the dividing line, he obviously neglects his duty. It may be indeed, and perhaps is contended, that there is no distinction at all. But this contention can only be established by fact. As far as the physiologist advances his line the psychologist must recede. There is, however, at present a clear domain into which physiology cannot advance, and any apparent advance of physiology, or even of physico-psychology, into this domain is merely illusory. Physiology can only tell us of things which accompany mental states or processes, or the exhibition of mental powers; it can tell us nothing about these states, processes, or powers themselves. This is the domain of psychology, and into it there is no prospect of physiology ever penetrating. The existence of a nerve may explain the transmission of sensation, the course of the nerve the direction of transmission, the motion of the nerve the speed of transmission, but neither nerve nor brain explains the fact of sensation. Suppose we learn that memory is always attended with a process of physical action, or with a permanent modification of some particular structure of the brain, how does this help us to explain the phenomenon of memory? or if we learn that the acquired habits of an animal effect physical modifications which are transmitted to succeeding generations, and become in them the bases or exciting cause of instincts, how does this enable us to understand instinct as a fact of consciousness? In these cases we only learn that the phenomena of consciousness are attended with certain circumstances, the connection of which with these phenomena is to us mysterious and inexplicable.

When then we observe phenomena which are beyond the range of physical explanation, when we call these phenomena mental, and ascribe them to an agent called mind, we do not necessarily ignore the association between mental and physical phenomena, but we establish a science of the former which reaches beyond, and is in its own sphere independent of the latter; that science, which, like physiology, is only a branch of the universal science, philosophy, is psychology.

PTARMIGAN. See GROUSE.

PTERICHTHYS ('winged-fish'), a genus of extinct fishes belonging to the order Ganoidei, and included in the sub-order Ostracostei of that division. This genus was first discovered in the Old Red Sandstone formations by the late Hugh Miller in 1833. The head and front half of the body were covered by large ganoid plates, these plates consisting of bone coated with harder enamel. The plates of the trunk formed a buckler-like shield, or back-plate and a breast-plate, these plates being articulated together at the sides or margins of the body. The several plates investing the body were joined by suture. The hinder part of the body and tail were covered by ganoid plates of smaller size, and these regions of the body may therefore have been endowed with a great degree of flexibility. A small and single dorsal or back fin existed, the tail-fin being unequally-lobed or heterocercal. A pair of ventrals and a pair of pectoral fins were also represented. The pectoral fins were peculiarly developed, their conformation giving rise to the scientific name of the genus. They consisted each of a strong spinous process composed of two segments, and covered by tubercular or small ganoid scales. In general form these fins are somewhat wing-like, and from their mode of attachment to the body must have been capable of a certain range of motion; but their chief office was probably that of aiding these fishes to shuffle along 'the sandy bottom or bed if left dry at low-water' (Owen). Locomotion was chiefly subserved by the caudal and dorsal fins. The armour-plating of the head seems to have been articulated by means of a movable joint to the trunk-buckler, this mode of articulation being

seen in the existing Lepidosteus or Bony Pike of the North American lakes.

These fishes are absolutely confined to the Devonian or Old Red Sandstone rocks, and are found in greatest abundance in these formations in the north of Scotland. The most familiar species is the *Pterichthys Milleri*—named after the discoverer of the genus, who wrote of his discovery as having laid bare 'one of the most extraordinary' organisms of the Devonian system, and 'one in which Lamarck would have most delighted.' Other species are the *P. cornutus*, *P. latus*, *P. major*, &c., these several species being distinguished and recognized by the proportions of the bucklers, of the pectoral fins, and of the tail. The jaws in all are of small size, and possess confluent denticles or rudimentary teeth. (See Pl. LXXXIII. fig. 6.)

PTERODACTYL ('winged-finger'), a remarkable genus of extinct Reptilia, forming the typical example of the fossil order Pterosauria. These forms were distinguished chiefly by the enormous elongation of the fifth or outermost finger, which served for the attachment of a *patagium* (which see) or flying-membrane, by means of which these forms could support themselves in the air, much after the fashion of our existing bats. No outer skeleton of scales, &c., seems to have been developed. The dorsal vertebræ are procœlous, or hollow in front and convex behind, the front ribs of the trunk possessing double heads. The cervical or neck vertebræ were of large size, those of the pelvis being exceedingly small. The breast-bone was broad, and, as in birds, bore a median ridge or keel for the attachment of the pectoral or breast muscles, which are used in flight. The sternal ribs were ossified. The jaws were elongated, and provided with teeth, set in *alveoli* or sockets. The head itself was of relatively large size. The eye was protected and strengthened by possessing a row of bony plates in its outer or sclerotic coat. The bones of the shoulder-girdle consisted of a shoulder-blade or scapula, and of large coracoid bones, which, as in birds, were attached directly to the breast-bone. No collar-bones or clavicles appear to have been developed. The bones of the fore-arm were elongated, the outermost finger, as already mentioned, being excessively developed in this respect, and clawless, whilst the other digits were furnished with claw-like nails. The number of phalanges (which see) in the fingers is progressive from the first to the fourth, this being a markedly reptilian character. The elongated finger gave support to a wing-membrane, which extended along the sides of the body to the comparatively small and weak hind limbs, and may have also stretched between the hind limbs and short tail. The bones were *pneumatic*, as in birds, that is, were hollow, and were filled with air instead of containing marrow; a disposition of structure adapted to render the body light for flying. That these reptiles possessed powers of flight analogous to existing bats seems most probable; the patagium of the bats differing from that of the Pterodactyls in being supported by *four* elongated fingers and not by one digit only. It is also to be borne in mind that the Pterodactyls were true reptiles and not allied in any intimate structural points to the bats. The Pterodactyls may also have been able to swim as well as to fly. The only living *reptile* which can support itself in the air is the flying lizard (*Draco volans*) of the Eastern Archipelago; and even this form cannot *fly* in the true sense of the word, but merely supports itself by its patagium in its aerial leaps from tree to tree.

The Pterodactyls are exclusively confined to the Mesozoic rocks, being found from the Lower Lias to the Middle Cretaceous rocks inclusive. The lithographic slates of Solenhofen in Bavaria, belonging to the Upper Oolitic system, are especially rich in Pterodactyl remains. Most of them are of small or moderate size; one specimen, however, from the Cretaceous rocks, must have measured more than 20 feet in expanse of wing from tip to tip. Familiar species, amongst many, are the *P. crassirostris*, *P. longirostris*, *P. longicollum*, *P. brevirostris*, *P. medius*, &c. (See also PTEROSAURIA. See Pl. LXXXIV. and LXXXVI.)

PTEROMYS. See SQUIRREL.

PTEROPIDÆ, PTEROPUS. See KALONG BAT.

PTEROPODA. See MOLLUSCA.

PTEROSAURIA, an extinct order of reptiles, represented by the Pterodactyls (which see), and by the genera Ramphorhynchus and Dimorphodon. This group, as mentioned in the article PTERODACTYL, is especially noted as containing forms which possessed the power of flight, the outermost digit or finger of the hand being greatly elongated so as to support a *patagium* (which see) or flying membrane. Mr. Seeley places the Pterosauria in a special class (that of the Ornithosauria) owing to their modifications for flight rendering them different from other groups of extinct reptiles. The Pterosauria are confined to the Mesozoic rocks. Dimorphodon possesses large, sharp, front teeth, and small, lancet-shaped hinder teeth. Ramphorhynchus has no teeth in the front portion of either jaw, but possesses hinder teeth in both jaws. The front portion of the jaws in the latter form may therefore have formed a bird-like beak. In Pterodactylus the jaws are fully provided with teeth, all of which are of elongated and slender shape. Dimorphodon is represented by the *D. macronyx* from the Lower Lias of Dorset. Species of this form show a skull of 8 inches in length and an expanse of wing of about 4 feet. The tail was probably short, whilst in Ramphorhynchus it was long, stiff, and slender. *Ramphorhynchus longicaudus*, *R. Gemmingi*, and *R. Münsteri*, all from the lithographic slates of Solenhofen (Upper Oolites), represent species of this genus.

PTOLEMAIC SYSTEM, the system of astronomy by which Ptolemy endeavoured to explain celestial motions. The earth is the fixed centre of the universe; a vast sphere, the 'primum mobile,' carries all the celestial bodies, and rotates once a day; the sun and moon travel in eccentric circles round the earth, and this accounts for the annual motion of the sun, and the monthly motion of the moon; each planet moves in a circular path, termed its epicycle, about a point, and this point travels in an eccentric circle round the sun; all motions in each order of circle being described uniformly, this explained the looped paths, the progressions, stations, and retrogradations of the planets. Every new astronomical observation required a new contrivance on this system, and at length the necessary cyclic and epicyclic combinations became excessively cumbrous. Copernicus taught that the daily motions of the sun and stars are only apparent, and that the earth turns on its axis.

PTOLEMAIS. See ACRE.

PTOLEMY (PTOLEMAIOS), the name of a line of Græco-Egyptian kings, who succeeded, on the division of the empire of Alexander the Great, to the portion of his dominions of which Egypt was the head. The name Ptolemy, though the common, was not the exclusive name of the kings of this dynasty, and they are better distinguished by the surname Lagidæ, from Ptolemæus Lagus, the founder of the dynasty, also surnamed Soter.

PTOLEMY I., called *Soter*, the Saviour, was by birth a Macedonian. His mother was Arsinoë, the mistress of Philip. His father is commonly reputed to have been Lagus, a Macedonian of humble birth; but the distinction with which Ptolemy was received at court has led some to attribute to him a higher origin.

According to Lucian he was born about B.C. 367, but on the supposition of his being a son of Philip it must have been some years later. Ptolemy was one of the intimate friends of Alexander, and was banished by Philip for the part he took in the intrigue for the marriage of the prince with the daughter of Pixodorus. He was recalled on the accession of Alexander. He attended the king on his expedition to Asia, but does not appear at first to have held any important command. In B.C. 330 he was admitted into the body-guard, and from this time he begins to appear in important transactions. In 329 he was sent with a detachment to apprehend Bessus, and in the reduction of Sogdiana he commanded one of the chief divisions of the army. During the Indian campaigns he was regularly employed in the most important commands, and distinguished himself alike for valour and capacity as a general. He continued on terms of intimate friendship with Alexander, and at the festivities of Susa he was honoured with a crown of gold, and obtained in marriage Artacama, sister of Barsiné. He accompanied Alexander in his last campaign in B.C. 324. On the death of Alexander he attached himself to the party of Perdiccas, and secured for himself the government of Egypt. One of his first acts on assuming the government was to put to death Cleomenes, the receiver-general of tributes, who had administered the province under Alexander, and had amassed vast treasures by arbitrary means. This measure was acceptable to the Egyptians, and tended to establish the independence of Ptolemy. He then proceeded to strengthen himself in his government, and concluded a secret league with Antipater against Perdiccas. In B.C. 322 he annexed Cyrene to his dominions. When war broke out in B.C. 321 Perdiccas himself marched against Ptolemy. He reached Pelusium with a numerous army, but was repulsed in his early attempts to force the positions of Ptolemy, and perished in a revolt of his own soldiers. In the arrangements made after the death of Perdiccas Ptolemy retained Egypt; he subsequently strengthened himself by a matrimonial union with Eurydice, daughter of Antipater. In the following year (B.C. 320) he seized the satrapy of Phœnicia and Cœle-Syria, which had been assigned to Laomedon. On the death of Antipater (B.C. 319) Ptolemy united with Cassander and Antigonus against Eumenes, and on the defeat of Eumenes by Antigonus he joined Cassander and Lysimachus against the latter. Antigonus invaded Syria in 315, overran Phœnicia, and laid siege to Tyre, which he took in 314. Ptolemy, who was master of the sea at the same time, occupied Cyprus, and attempted to gain over the Greek cities. Cyprus revolted in 313, and Ptolemy proceeded thither in person, and reduced the whole island. In 312 he invaded Palestine, and with Seleucus defeated Demetrius, son of Antigonus, at Gaza; but when Antigonus advanced into Syria to the relief of his son he retired into Egypt. In B.C. 311 a general peace was effected, but it was not of long duration. It was broken by Ptolemy in 310. On the plea that Antigonus had not withdrawn his garrisons from Asia Minor he sent a fleet to Cilicia, which reduced some of the cities on the coast, but withdrew on the approach of Demetrius. In B.C. 309 Ptolemy invaded Lycia, and took several cities, but Demetrius having come to the relief of Halicarnassus, which he was besieging, he withdrew to Myndus. In 308 he invaded Greece, and proclaimed himself as a liberator; but he made little progress, and having garrisoned Corinth and Sicyon, which he lost some years later, he returned to Egypt. His brother at the same time recovered Cyrene, which had thrown off the yoke of Ptolemy. Antigonus now resolved to wrest Cyprus from Ptolemy (B.C. 307), who advanced to its relief with a powerful fleet. The Eyptians were totally defeated at Salamis, and Cyprus fell into the hands of the victor, who assumed the title of king. This example was followed by Ptolemy B.C. 306. Antigonus now advanced against Egypt through Syria with a powerful army, supported by a fleet under the command of Demetrius. Ptolemy fortified the passages of the Nile, which Antigonus was unable to force, and was compelled to retire. Next year Ptolemy contented himself with assisting the Rhodians against Demetrius. It was from the Rhodians on this occasion that he acquired his surname of Soter. In 302 a league was formed against Antigonus, including Seleucus, Lysimachus, and Cassander, along with Ptolemy. Ptolemy did not take a very active part in the league; he advanced into Cœle-Syria, but being alarmed by a false report that Antigonus had won the battle of Ipsus he retired to Egypt. The defeat and death of Antigonus in this battle raised Seleucus to a position of great power, and a dispute ensued between him and Ptolemy for the possession of Cœle-Syria and Phœnicia, which were ultimately acquired by Seleucus. Ptolemy now entered into alliance with Lysimachus and Demetrius. He received at his court Pyrrhus of Epeirus, gave him his step-daughter Antigone in marriage, and assisted him in recovering his throne. In 295 Ptolemy recovered Cyprus, which became a permanent dependency of Egypt. In 287 he joined in a league with Lysimachus and Seleucus against Demetrius, who, after losing all his possessions in Asia, had become king of Macedonia, and was making great preparations for an eastern expedition. Ptolemy assisted the allies with a fleet, and the war against Demetrius was successful. Ptolemy had two sons by Eurydice, but he determined to bestow the crown on Ptolemy Philadelphus, a younger son by his favourite wife Berenice. He announced his own retirement, and caused him to be proclaimed as his successor, in B.C. 285. He died two years after, B.C. 283. Ptolemy is regarded as the most prudent of the successors of Alexander. His internal administration of Egypt was enlightened and successful. He raised Alexandria to the highest rank in commercial prosperity. He founded in that city a colony of Jews, to whom the special place taken by Alexandria in subsequent times in philosophy and literature, as well as in politics, was in great measure due. He was also an eminent patron of literature, science, and art, and founded the library and museum of Alexandria. He himself wrote a narrative of the wars of Alexander, which is used as an authority by Arrian.

PTOLEMY II. (*Philadelphus*) was born in Cos, B.C. 309. His tutors were Philetus of Cos and Zenodotus, from whom he received a careful education. He was raised to the throne, as already mentioned, during the lifetime of his father. His reign was generally peaceful. His half-brother Magas, who governed Cyrene, made himself independent on the death of his father, invaded Egypt, and made alliance with Antiochus II., king of Syria. Ptolemy at length acknowledged his independence, and betrothed to him the infant daughter of his son Ptolemy. Cyrene was subsequently reunited with the monarchy by the marriage of his son Ptolemy with Berenice, daughter of Magas. Ptolemy sent a fleet to assist the Athenians against Antigonus Gonatas. He concluded a treaty with Rome after the defeat of Pyrrhus, and continued faithful to his alliance during the Carthaginian war. There was a chronic but uneventful war carried on during his reign with Syria. Towards the close of his reign it was terminated by the marriage of Ptolemy's daughter Berenice to Antiochus III. Either by the treaty

or in the course of the war Ptolemy acquired Cœle-Syria and Phœnicia. He was also, in general, on hostile terms with Macedonia. But the chief care of Ptolemy was directed to the internal administration of his kingdom and the encouragement of commerce. He carried his arms into Ethiopia, and founded the fortress of Ptolemais to protect the trade in elephants, which were brought from these regions to Egypt for warlike purposes. He founded Arsinoë (on the site of Suez) to protect the navigation of the Red Sea, and Berenice, on the Red Sea coast, under the Peninsula of Lepte (Ras Benass); from the latter place he formed a road to Coptos on the Nile, by which the caravans and the commerce of India and Arabia continued for ages to pass to Alexandria. The chief glory of Philadelphus was his munificence as a patron of science and literature. He raised the institutions founded by his father to the highest degree of splendour. He spared no pains to fill the library of Alexandria with all the treasures of ancient literature. Like his father he associated on familiar terms with the learned men who frequented his court. Among the architectural works of merit erected during his reign were the lighthouse on the island of Pharos, the Alexandrian Museum, and the royal burying-place, to which he removed the remains of Alexander and those of his father. He founded numerous cities and colonies not only in Egypt, but in Syria and Cilicia. It is no disparagement to say that the schemes of Ptolemy were mainly calculated to promote the prosperity of his Greek subjects, seeing the Egyptians were not oppressed, and Greek civilization was the highest known to him. He is supposed to have been the patron of Manetho in his Greek rendering of Egyptian history, and there is a tradition that it was at his instance that the Seventy made their translation of the Old Testament. During his reign the dominion of Egypt extended into Ethiopia, Arabia, and Libya, and embraced the provinces of Phœnicia and Cœle-Syria, besides extensive tracts in Asia Minor and the islands of the Mediterranean. In his private life there were many excesses. He put to death some of his near relatives, and he violated the religious principles of the Greeks in relation to marriage by marrying his sister Arsinoë, the widow of Lysimachus, and his senior. It was in relation to her he assumed the surname of Philadelphus. He called many of his cities after her, erected a temple to her memory, and caused divine honours to be paid to her. Ptolemy died in 247. He was succeeded by Ptolemy III., his son by his first wife Arsinoë, daughter of Lysimachus.

Ptolemy III., surnamed *Euergetes*, was early engaged in an important war. Antiochus III. of Syria had put away his wife Laodice to marry Berenice, daughter of Ptolemy II. On the death of Philadelphus he put away Berenice and restored Laodice. The resentment of Laodice, however, was not appeased, and she sacrificed to her revenge her husband, her rival, and their infant son. Ptolemy took up arms too late to save his sister, but with a view to avenge her he invaded Syria, and advanced without opposition to Antioch, when he turned his arms eastward, subdued Mesopotamia, Babylonia, and Susiana, and advanced to the confines of India. He was recalled to Egypt by intelligence of seditions having broken out in his absence, and he brought with him the statues of Egyptian gods which had been carried off by Cambyses, which he restored to their respective temples, and thus earned the title of Euergetes (benefactor) from his subjects. The fleets of Ptolemy had at the same time subdued the coasts of Asia Minor, and carried his arms to the Hellespont and to the coast of Thrace. After Ptolemy's return to Egypt, the date of which is uncertain, Seleucus, son of Antiochus, recovered a considerable portion of his father's dominions, especially of the eastern provinces, while the maritime regions and part of Syria remained in the possession of Ptolemy. Ptolemy made use of Antiochus Hierax, the younger brother of Seleucus, to promote division in Syria, supporting him in wars against his brother, and thus preventing Seleucus from extending his conquests. Antiochus was at length totally defeated, and compelled to take refuge in Egypt. Ptolemy took some part in the affairs of Greece generally, as was the policy of Egypt, against the rulers of Macedonia. He maintained friendly relations with Rome, but declined the assistance of the Romans in his war with Syria. In the latter part of his reign he made war with the Ethiopians, and extended his dominion in the south of Egypt. Ptolemy continued the patronage of literature, and added largely to the library of Alexandria. Like his predecessors he was the patron of scholars, and his court was the resort of the most distinguished men of his day. In his reign the Græco-Egyptian kingdom attained its highest prosperity at home, and its widest dominion abroad. He exhibited also more than his predecessors of the feeling of a native Egyptian king, and by his recovery of their sacred treasures recalled to his subjects the glories of their ancient history. He also repaired and enlarged the Egyptian temples, and dedicated new shrines to the national gods. He died in B.C. 222.

Ptolemy IV., surnamed *Philopator*, was suspected, though probably without ground, of poisoning his father, whom he succeeded, and the beginning of his reign was marked by atrocious crimes. He put to death his mother Berenice, his brother Magas, and his uncle Lysimachus, and, giving himself up to indolence and sensual gratification, abandoned the cares of state to his minister Sosibius, his adviser in these and other crimes. With this vicious reign began the decline of the kingdom. Roused from his lethargy by the loss of his Syrian possessions, which had been gradually wrested from him by Antiochus the Great, Ptolemy put himself at the head of a large army and completely defeated Antiochus at Raphia, in B.C. 217. By this victory he recovered Cœle-Syria, but being too indolent to pursue his success he speedily made peace and returned to his pleasures. On his return he began to persecute the Jews of Alexandria, having, it is said, been offended at the refusal of the high-priest to admit him to the sanctuary in the temple of Jerusalem. A revolt of the native Egyptians at the same period led to a protracted struggle, and caused much bloodshed. Ptolemy married his sister Arsinoë, and near the close of his reign, with the assistance of Sosibius, put her to death. He then gave himself up more completely to debauchery, which probably shortened his career, and died B.C. 205. Philopator continued in general the policy of his ancestors. He patronized literature, and dedicated a temple to Homer as a divinity. During the Carthaginian war he supplied the Romans with corn. He prided himself in building galleys of unusual size, one of which is said to have had forty banks of oars.

Ptolemy V. (surnamed *Epiphanes*), the son and successor of Ptolemy IV., was under five years old at his father's death. Agathocles, brother of the late king's mistress, assumed the reins of government, and kept the death of the king secret in order to assure his power. He and his sister, with their supporters, were, however, put to death in a popular insurrection, when Sosibius, the son of the late minister, attempted to make himself master of the king's person and of the government; but had to give place to Tlepolemus, a popular soldier, who had little

administrative capacity. In these circumstances Philip of Macedon and Antiochus III. (the Great) of Syria combined to dispossess Ptolemy, and divide his dominions. Philip began to reduce the Cyclades and the cities of Thrace which belonged to Egypt, while Antiochus invaded Cœle-Syria. Instead of relying on the internal resources of the kingdom to repel this danger, the guardians of the young king took the fatal step of placing him under the protection of Rome. The charge was gladly accepted by that powerful and crafty state, and Philip and Antiochus were commanded to restore their conquests. Antiochus had already wrested from Ptolemy nearly all his Syrian possessions, as well as the cities held by the Egyptian kings in Lycia and Cilicia. To avoid embroiling himself with the Romans, he agreed, B.C. 199, to give Ptolemy his daughter Cleopatra in marriage, with the Syrian provinces as her dower. The marriage took place in B.C. 193–192, and in the interval of peace Egypt began to recover prosperity under the administration of Aristomenes. Several revolts, however, took place, and in B.C. 196 it was determined to declare Ptolemy of age. During the war between Antiochus and the Romans Ptolemy continued in strict alliance with the latter, but at the conclusion of the war Antiochus still held possession of Cœle-Syria and Phœnicia. After the death of Aristomenes the government of Egypt was chiefly conducted by Polycrates, who encouraged the king to give himself up to debauchery. Ptolemy was cut off by poison, while he was preparing to recover Cœle-Syria from Seleucus, the successor of Antiochus, B.C. 181. Nearly all the foreign possessions of Egypt were permanently lost during the unfortunate minority of this reign.

PTOLEMY VI. (surnamed *Philometor*) was also a child at the death of his father. His mother Cleopatra, who assumed the regency, maintained peace and preserved internal tranquillity by an able administration; but the ministers who succeeded after her death (B.C. 173) provoked a war with Antiochus Epiphanes, and were totally defeated near Pelusium. Antiochus advanced to Memphis and took Ptolemy prisoner (B.C. 170). Upon this incident the brother of Ptolemy caused himself to be proclaimed king at Alexandria, under the title of Ptolemy Euergetes II. Antiochus besieged Alexandria, but the intervention of the Romans caused him to retire. He re-established Philometor as king at Memphis, and returned to Syria. After his withdrawal Philometor came to an understanding with his brother. He agreed to marry his sister Cleopatra, and to reign jointly with Euergetes. In consequence of this reconciliation Antiochus again invaded Egypt, and advanced to Alexandria, but on the peremptory demand of the Romans he again retired to his own dominions, B.C. 168. Dissensions now broke out between the brothers, and Philometor being expelled from Alexandria repaired to Rome B.C. 164. By the intervention of the Romans he was replaced, but agreed to erect Cyrene into a separate kingdom for Euergetes, who afterwards persuaded the Romans to grant him Cyprus also. This occasioned long disputes and negotiations, but Philometor finally retained Cyprus, which he defended by force of arms. In the dispute between Demetrius Soter and Alexander Balas for the possession of Syria, Philometor supported the latter, and in B.C. 150 gave him his daughter Cleopatra in marriage; but Alexander having repaid his alliance with treachery, he concluded peace with Demetrius, gave Cleopatra to him, and conquered Syria on his behalf. He died in battle against Alexander, in which the latter was defeated, B.C. 146. In the later part of his reign he showed an energy of which he did not at first appear capable, and he is generally praised for the mildness and moderation of his character. During his reign a great migration of Jews, caused by factions in their own country, took place from Palestine into Egypt.

PTOLEMY VII. (surnamed *Euergetes* and also *Physcon*) was King of Cyrene at the death of his brother. Cleopatra caused her infant son to be crowned; but Ptolemy invaded Egypt, and by the intervention of the Romans it was agreed that he should marry Cleopatra and be recognized as king. Immediately after the marriage he put his nephew to death. His reign was one of tyranny and bloodshed, and by his violence he drove the citizens of Alexandria to exile themselves in great numbers. He divorced Cleopatra in order to marry her daughter by Philometor, who bore the same name. He was compelled at length to flee from the indignation of his subjects, and escaped to Cyprus B.C. 130. Here he perpetrated further atrocities, but Cleopatra having made herself unpopular by applying to Syria for aid against him he was restored to the throne of Egypt B.C. 127. He afterwards intervened in the affairs of Syria, became reconciled to his sister Cleopatra, whose son to himself he had barbarously murdered, and died B.C. 117 in peaceable possession of the throne of Egypt. This monster was not only a patron of literature, but himself the author of a considerable work on natural history.

PTOLEMY VIII. (surnamed *Soter II.*, and also *Philometor*, *Lathyrus*, and *Philadelphus*) was the son of the last Ptolemy by his niece Cleopatra. He was already married to his sister Cleopatra at the time of his accession. His mother compelled him to divorce her and marry his younger sister Silene, in spite of his preference for Cleopatra, and for ten years she continued to sway the government, although she and her son were frequently opposed in policy. She at length accused him of conspiring against her life, and he was compelled to flee, B.C. 107. For eighteen years he continued to hold Cyprus as an independent kingdom. During this period he took part in the wars of Syria, and in B.C. 103 defeated Alexander Jannæus, king of Judæa, and made himself master of the coasts of Palestine. His mother thereupon marched against him with an army, and he finally retired to Cyprus. During subsequent wars they were constantly opposed to each other. After the death of Cleopatra (B.C. 90) he was recalled to Egypt, which he governed till his death in B.C. 81. Thebes revolted and held out against him for three years. He was succeeded by his daughter Cleopatra.

PTOLEMY IX. (otherwise called *Alexander I.*) was the youngest son of Ptolemy VII. by his niece Cleopatra. On the death of his father his mother wished to place him on the throne, but failing in this she sent him to Cyprus, where three years after he assumed the title of king. On the expulsion of Ptolemy VIII. he was recalled by his mother, and shared with her the throne of Egypt, although he appears to have had little power. The violence of his mother at length caused him to flee; but being persuaded to return, and suspecting her of designs against his life, he caused her to be assassinated. After reigning a year he was expelled by an insurrection of his people and soldiers, who recalled his brother. He was killed in battle at Cyprus B.C. 81–80.

PTOLEMY X. (or *Ptolemy Alexander II.*), son of the preceding, was nominated king of Egypt by Sulla on the death of Ptolemy VIII.; but the Egyptians having already placed Cleopatra Berenice, the daughter of that king, on the throne, it was arranged that he should marry her and admit her to a joint sovereignty. Nineteen days after the marriage he caused her to be assassinated, upon which the Alex-

andrians rose in insurrection, dragged him to a gymnasium, and put him to death B.C. 80.

PTOLEMY XI. (*Auletes*—surnamed *Neos Dionysus*), an illegitimate son of Ptolemy VIII., succeeded Ptolemy X., with whom the legitimate race of the Lagidæ became extinct. The early part of his reign appears to have been distinguished by no political transactions of importance. In vice and debauchery he appears to have rivalled the worst of his predecessors. To procure the ratification of his title, which was long delayed, he gave immense bribes to the Romans, and the oppressive taxes he was thus compelled to impose caused his expulsion by the Alexandrians in B.C. 58. He repaired to Rome to procure his restoration, and when the Alexandrians sent deputies against him he caused them to be waylaid and murdered. In consequence of this a strong opposition was excited to his claim, and he withdrew to Ephesus in disgust, but in B.C. 55 A. Gabinius, proconsul of Syria, by the influence of Pompey and a bribe of 10,000 talents, was induced to restore him. The Egyptians, who had placed Berenice, the daughter of Ptolemy, on the throne, were defeated, and Ptolemy put Berenice to death. During the rest of his reign Egypt was occupied by the Romans, and the revenues collected to defray his obligations to them. He died B.C. 51.

PTOLEMY XII. (*Auletes*), son of the preceding, reigned jointly with his sister Cleopatra till B.C. 48, when Cleopatra was expelled, and raising an army in Syria invaded Egypt. It was at this time that Pompey landed in Egypt after his defeat, and was assassinated by Pothinus and Achillas, the ministers of Ptolemy. On the arrival of Cæsar Cleopatra by her charms acquired an ascendency over him, which made it manifest that he would decide her dispute with Ptolemy in her favour. Thereupon Pothinus raised an insurrection against Cæsar. Ptolemy put himself at the head of the insurgents, was defeated by Cæsar, and drowned in attempting to make his escape in B.C. 48 or 47.

PTOLEMY XIII. (*Auletes*), the youngest son of Ptolemy XI., was declared king by Cæsar in conjunction with Cleopatra in B.C. 47. He was married to his sister, but being only a boy possessed no more than the name of husband or king. He was put to death by Cleopatra in B.C. 43. See Dr. Smith's Dictionary of Greek and Roman Biography and Mythology.

PTOLEMY (CLAUDIUS PTOLEMÆUS), the celebrated astronomer and geographer. Neither the time nor place of his birth, nor any of the events of his life, is known. He appears to have resided in Alexandria, where he made astronomical observations in 139, and he was alive in 161. He was the first systematic writer on Greek astronomy whose works are now extant; but his astronomical labours are chiefly based on those of Hipparchus (see HIPPARCHUS), who lived about 300 years before him, and whose calculations he adjusted to his own time. Ptolemy's great astronomical work is entitled Megalē Syntaxis tēs Astronomias, and is more commonly known by the Arabic title Almagest. It contains an exposition of the system of the world, of the order and revolutions of the heavenly bodies, a treatise on rectilineal and spherical astrology, and a complete description of the astronomical instruments used by the Greeks. His system, founded on the apparent movements of the heavenly bodies, and which is still known by his name, was only superseded by that of Copernicus. His Geography (Geōgraphikē Huphēgēsis) is a work of equal historical importance. As an authority it maintained its ground till the commencement of maritime discovery in the fifteenth century. It contains little descriptive information, but gives a complete list of names of places, with their longitudes and latitudes as received in his time. The latitudes are generally based on accurate observation; but the longitudes, founded on a false assumption of the extent from east to west of the known world, which he made much greater than the reality, are very inaccurate. This occasioned the error in the calculations of Columbus and his contemporaries as to the distance west of Europe of the eastern shores of India, which they made too short, and consequently to the early supposition that America was India. The chief authority followed by Ptolemy in his geography is Marinus of Tyre.

There are numerous other works of Ptolemy's extant, among which may be mentioned a chronological catalogue of the kings of Persia, Greece, and Rome, which has been found valuable to historians; a treatise on the theory of the musical scale, two astrological treatises, and several other works on mathematics, astronomy, optics, and other sciences. The best edition of the Almagest is by Halma (Paris, two vols. 4to, 1813–16), of the Geography, by Peter Bertius (folio, Antwerp, 1624); there are two vols. of miscellaneous works of Ptolemy published by Halma (1819–20).

PUBERTY, the period in both male and female marked by the functional development of the generative system, and by a corresponding aptitude for procreation. This period is marked in both man and woman by certain characteristic signs. In the male puberty is generally attained between the age of fourteen and sixteen years in temperate climates; and although this period may be reached at an earlier age in warm regions, yet, as will presently be noticed, climatic conditions do not appear to affect the male in so prominent or marked a degree as the female. Previously to the attainment of the age designed by nature as that at which the generative functions assume their functional activity, the physical powers have been appropriated to the nutrition of the frame. This fact is in accordance with a well-known and reasonable law of physiology, whereby the processes of nutrition and reproduction are found to be antithetical to each other—in other words, the reproductive energies of the body are opposed to the nutritive, and act as an important drain upon the physical and nutritive powers. No law seems more clearly established than this, and therefore it is that we find the generative instincts limited or restrained until a period when the nutrition and growth of the being has been duly advanced.

In man the occurrence of puberty is marked by a varied and general change in the entire physical constitution of the individual. The body attains, within a comparatively short period, a large relative increase in size. The form acquires greater fulness and stamina. The larynx particularly enlarges, and the voice attains the deeper pitch of the manly estate. The chin and pubis become covered with hair, and the entire sexual system receives an unwonted stimulus, the testes secreting the seminal fluid characteristic of full sexual vigour. As time passes the changes thus inaugurated become more and more intensified, the full assumption of the form and mind of the man completing the more marked period of puberty. The male thus becomes sexually perfect. The sexual powers in man are retained to a much later period of life than in woman. Instances are on record in which they have been retained till the age of 100—as in the well-known case of old Parr. But in ordinary cases the virile powers of man visibly decrease after the age of fifty or sixty years; the energies of declining years being, as in childhood, withdrawn from the reproductive, and again devoted to the nutritive interests of the individual.

In woman the period of puberty is much more important than in man, for the reason that changes of a much greater extent are thereby induced, and certain important processes in connection with the sexual instincts are then for the first time brought to functional perfection. In the female, therefore, we find that the epoch of puberty commences in temperate climates from the thirteenth to the sixteenth years. But it is notable that in females puberty may be attained at a much earlier age, or may be greatly delayed; the explanation of these anomalous cases depending rather upon individual constitution and hereditary peculiarities than upon causes of a more general kind. It appears as a rule to be attained at an earlier period in tropical climates, in those delicately nurtured, and in the inhabitants of towns, as opposed to the ill-fed or country residents. At this period, and more markedly than in man, the female form acquires a fulness and roundness of characteristic kind. The breasts enlarge, depositions of fat taking place in the mammæ and on the pubes, and over the body generally. The internal organs of generation also enlarge, and their functional perfection in woman is marked by the most unequivocal of the signs of puberty, namely, the appearance of *menstruation* (which see), or the *catamenial discharge*. This latter consists of a flow of blood from the internal generative organs; but as explained in the articles MENSTRUATION, OVARY, and OVUM, this sanguineous flow is only to be regarded as symptomatic of the true and deeper process of *ovulation*, or the discharge of ova or eggs from the ovary. The occurrence of ovulation, or in other words the production of ova, liable and ready for fertilization, and so to develop a new being, is the most essential and significant sign of the full attainment at once of puberty and of the true female generative functions.

Puberty in both man and woman may be retarded or advanced by individual peculiarities of constitution, and, as already remarked, by the surrounding circumstances of life. Regarding the influence of climate it has been argued that women, like plants, attain maturity soonest in tropical climates. The real facts of the case appear to be (as demonstrated by Mr. Roberton of Manchester, in his Essays on Menstruation, &c., 1851) that in temperate climates the occurrence of puberty is extended over a longer range of ages, or series of years, than in tropical climates; although, *cæteris paribus*, the inhabitants of warm regions attain to maturity at an earlier age than those of cold latitudes. This may, of course, be partly due to the general influence of heat and food in determining an earlier development of all the physical functions, in which development the generative organs would of course readily participate. The average period of puberty and the average of early dates are thus found to exhibit no very great difference in the inhabitants of cold and warm climates. Exceptional instances occur in which civilizing or other influences may affect the appearance of puberty. Notably in the case of Hindu females puberty is attained uniformly at a period about two years before its occurrence in Europeans; the average period in the Hindu female at which puberty occurs being thirteen years, and that in the British female fourteen years eleven months. A larger proportion of the first menstruations of Asiatic women occurs in the earlier years of the period over which puberty ranges in British women, as has been clearly shown by a table drawn up by Mr. Roberton. It is further stated that the negresses of Demerara and the West Indian Islands generally, the temperature of which countries is higher than that of India, do not attain puberty earlier than the peasants of England. The cause of early puberties in the Hindus and other eastern nations is probably to be found in the sexual habits and laws of marriage of these nations, together with hereditary influences dependent upon these customs.

The cessation of the catamenial flow, and the stoppage of the generative functions in woman, generally occur about the forty-fifth year of life; the aptitude for procreation in woman ceasing more definitely and regularly, and at a much earlier period, than in man. Cases are rare in which children have been born by mothers exceeding fifty years of age.

PUBLICANI, farmers of the public revenue in the Roman state. The revenues derived from the tribute of foreign countries were sold or let for a period by the censors in Rome to the highest bidder. The sale was generally made for a *lustrum* or period of five years. The conditions of the sale were generally determined by law, but were sometimes modified on particular occasions. The tithes of Sicily, except those of wine, oil, and garden produce, were by a custom introduced by Hiero not sold in Rome but in Sicily. The farmers of the revenue belonged to the wealthiest classes, and during the later period of the republic were generally of the equestrian order. They were required to give security to the state for the price at which they purchased any branch of the revenue, and for this purpose they generally united in companies, recognized by the state, and called *socii*, which divided the venture into shares (*partes*). The contract with the state was made in the name of one responsible individual, called *manceps*, and the business manager of the company was called *magister*. The *magister* resided at Rome and corresponded with the agents in the provinces. None but Roman citizens could be a member of a company of publicani, and magistrates and governors of provinces were excluded from them. The actual work of collection was conducted by an inferior class of servants of the company, who might either be freedmen or slaves, Romans or provincials. To this class belong most of the publicans mentioned in the New Testament.

PUBLIC HEALTH ACTS. Besides general and particular acts against nuisances the necessity for general measures for protecting the health of towns has given occasion to special legislation. An act known as the Public Health Act, 1848, was passed in that year (11 and 12 Vict. cap. lxiii.), appointing a general board of health, with subordinate local boards throughout the country, with power to levy rates and regulate matters concerning the public health. This act has been several times amended, particularly by the Public Health Act, 1875. This act, like the act of 1848, does not apply to Scotland or Ireland, nor to the metropolis, except as regards special provisions. Under its introductory provisions sanitary districts are divided into urban and rural, the former being limited by the sanitary jurisdiction of corporations, improvement commissioners, and local boards; the latter by that of boards of guardians. Part 3 consists of what are specially termed sanitary provisions. It is divided into the heads of:—1, sewerage and drainage; 2, water-closets, privies, &c.; 3, scavenging and cleansing; 4, water supply; 5, regulation of cellar dwellings and lodging-houses; 6, nuisances; 7, offensive trades; 8, unsound meat, &c.; 9, infectious diseases and hospitals; 10, prevention of epidemics; 11, mortuaries. Each head includes the corresponding statutory regulations, together with the penalties by which they are to be enforced. Part 4 contains under several heads the law on such matters of local government as are only indirectly connected with the question of public health. These heads are:—1, Regulations with regard to highways and streets, including the power for widening, improving, paving, and lighting them; 2, public pleasure-grounds; 3, markets and slaughter-houses; 4, police

regulations. Part 5 relates to the general powers and methods of which local authorities may avail themselves. It defines their power to enter into contracts, to purchase lands, to have recourse to arbitration, to make and alter bye-laws, to appoint officers, including the medical officer of health, and it regulates the mode of conducting their business. Part 6 relates to powers of rating and borrowing, and contains full provisions for the assessment of general district rates, private improvement rates, and highway rates. The expenses of rural authorities are dealt with by a division into general and special heads, the former being payable from a common fund, and the latter being a special charge on each contributory place, both being chargeable on the poor-rates. Borrowing powers are defined and regulated, and due provision is made for audits. Part 7 relates chiefly to the prosecution of offences, the recovery and application of penalties, and the service of notices. Part 8 defines the powers of the Local Government Board in the alteration of areas and union of district exercised by provisional orders and otherwise, including the power to invest rural authorities with all or some of the powers granted to urban authorities. Any urban or rural districts may be united either for the purpose of procuring a common supply of water, or of carrying into effect a common system of sewerage, or for any other purposes of the act. Districts may be united for the purpose of appointing a more competent officer of health. Port sanitary authorities are constituted under this head, and their jurisdiction and powers defined. Part 9 sets forth the powers possessed by the Local Government Board upon default of the local authorities, and the provisions for the recovery of expenses consequent upon such default, and the power of the Board to alter and repeal local acts, and to settle differences consequent upon the transfer of powers and duties of the various local authorities. Part 10 consists of a collection of provisions not included under the previous heads. Various saving clauses relating to navigation and water rights, and to certain exemptions of a local nature, bring the act to a close. The schedules contain, among other things, complete rules for the election of local boards. Supplementary acts for facilitating the improvements of the dwellings of the working classes in large towns, and to empower local authorities to acquire, construct, and maintain proper cemeteries were passed in 1879 and 1882.

PUBLIC-HOUSES. See INN AND INNKEEPER, and LICENSING ACTS.

PUBLIC STOCKS OR FUNDS. See FUNDS.

PUBLIUS SYRUS, so called because a native of Syria, was carried as a slave to Rome when a mere boy, but was fortunate in meeting with a kind master, who, perceiving his talents, gave him a good education, and afterwards set him free. His talent was particularly displayed in writing *mimi*, or farces, at a time when that species of drama was most in fashion; and Julius Cæsar, with whom he was contemporary, preferred him to all his competitors. His farces were interspersed with moral sentences, a collection of which is stated by St. Jerome to have been made and used by the Romans as a school-book. A number of these apothegms, forming the only fragments of his works still extant, have been published in various collections of Latin authors under the title of Publii Syri Sententiæ.

PUCK (Old Swedish, *puke;* Icelandic *puki*, an evil demon, a word equivalent to Irish *puca*, Welsh *pwca*, an imp), in mediæval mythology a celebrated fairy, 'the merry wanderer of the night;' he was also known by the names of Robin Goodfellow, Friar Rush, Pug, &c., in England; and in Germany by that of Knecht Ruprecht, although in both countries he is best known by his designation of Puck. Under the latter appellation his character and attributes are represented in Shakspere's Midsummer Night's Dream. He was chief of the *brownies* or domestic fairies, and many tales are told of his nocturnal exploits.

PÜCKLER-MUSKAU, HERMANN LUDWIG HEINRICH, PRINCE OF, a German traveller and author, was born at Muskau, Saxony, 30th October, 1785. After having studied law at Leipzig from 1801 to 1803 he entered the army, which he soon after quitted with the rank of captain, and travelled in Italy and France. In 1813 he entered the Russian service as major, and subsequently was appointed an aid-de-camp to Prince Charles Augustus of Saxe-Weimar. Having greatly distinguished himself in the Netherlands he received the rank of lieutenant-colonel, and later on was appointed civil and military governor of Bruges. On the conclusion of peace he retired to his estates and devoted himself to literature and horticulture; he also travelled a good deal. In 1822 he was created a prince by the King of Prussia. He travelled in France and England in 1828, and subsequently spent several years travelling in Asia and Africa. Some time after his return he sold his estates at Muskau and passed his time in various parts of Germany and Italy. In 1863 he was elected a member of the Prussian *Herrenhaus*, or Chamber of Peers. He was on the staff of the King of Prussia during the war of 1866, though then in his eighty-first year; and he died Feb. 4, 1871. His writings, which are numerous, are of a lively and original description; among them his letters from England, translated under the title, The Tour of a German Prince (three vols. London, 1831), attracted considerable attention from its familiar pictures and revelations of aristocratic life. Other works of his are Briefe eines Verstorbenen (Munich and Stuttgart, 1831), Semilasso's vorletzter Weltgang (ib. 1835), Semilasso in Africa (ib. 1836), Aus Mehemed Ali's Reich (ib. 1844), and Die Rückkehr (Berlin, 1846–48).

PUDDINGSTONE, the name given by geologists to a conglomerate composed of rounded fragments of different sorts embedded in a siliceous matrix (like fruit in a plum-pudding). The puddingstones abound among stratified rocks, where they occur in beds, masses, veins, and boulders of greater or less size. The puddingstones may form rounded hills, and sometimes even mountains, as in the Vosges.

PUDDLING FURNACE. See IRON.

PUDSEY, a town and township, England, in the West Riding of Yorkshire, on the brow of a lofty acclivity above the valley of the Aire, 6 miles west of Leeds. It has recently increased from a few scattered hamlets to a considerable town; and has a spacious and elegant modern church, with an embattled and pinnacled tower; several dissenting places of worship; spacious board and other schools; mechanics' institute, &c. Woollen and worsted manufactures are extensively carried on, and there is also a large manufacture of boots and shoes. There are many building-stone quarries in the vicinity. Pop. of local board district (1881), 12,300.

PUEBLA, LA, a department of the Mexican Confederation; bounded south by the Pacific, and surrounded on other sides by Vera Cruz and Oaxaca; area, 12,042 square miles. Its centre is intersected by the Cordillera of Anahuac, in which is the volcano of Popocatepetl, the highest mountain in Mexico. Its principal river is the Nasca. The soil is fertile in corn, maize, and fruit-trees. Cotton, sugar, and other tropical productions also succeed well; and there are besides silver-mines and quarries of excellent marble. The principal towns are La Puebla, Tepeaca, and Tehuacan. Pop. (1882), 784,446.

PUEBLA, La, the capital of the above department, is finely situated on a declivity, 74 miles E.S.E. of Mexico, next to which it is the largest city in the confederation. It has wide, regular, and well-paved streets, supplied with foot-paths; houses generally three stories high, with flat roofs; large and elegant squares, in the principal one of which is situated the cathedral, a magnificent structure. In all there are seventy-two religious edifices, including forty-three large churches, many of them highly decorated; and above 100 towers rising above the houses impart a characteristic feature to the city. There are also several colleges, academies, schools, alms-houses, and hospitals. The principal manufactures consist of glass, earthenware, and soap. Puebla was built by the Spaniards in 1533. It was temporarily surrendered to the French, after undergoing a siege of three months' duration, in May, 1863. Pop. (1882), 65,000.

PUERPERAL FEVER, a disease peculiar to women in childbed; it is also called *puerperal peritonitis*, being an inflammatory affection of the peritoneum. It is frequently complicated with inflammation of the womb and its appendages, and is far from being either a simple or unvarying malady, as it assumes the most diverse types and forms, and is considered the most fatal disease to which women in this state are liable. From careful observations of the disease, made during a long period of years, it has come to be generally considered epidemic, and a large mass of evidence has been adduced to show that it is also contagious. It is consequently much more prevalent in lying-in hospitals than in private practice. The symptoms and characteristic features of the disease vary very much, according to the circumstances that occasion it and influence its course. It usually attacks the patient about the third day after delivery, and is generally 'preceded or attended by shivering and sickness or vomiting, and is marked by pain in the belly, which is sometimes very extended, though in other cases it is at first confined to one spot. The abdomen very soon becomes swelled and tense, and the tension rapidly increases. The pulse is frequent, small, and sharp; the skin hot; the tongue either clean or white and dry; the patient thirsty; she vomits frequently, and the milk and lochia usually are obstructed. These symptoms often come on very acutely, but they may also approach insidiously. But whether the early symptoms come on rapidly or slowly, they soon increase; the belly becomes as large as before delivery, and is often so tender that the weight of the bed-clothes can scarcely be endured; the patient also feels much pain when she turns; the respiration becomes difficult, and sometimes a cough comes on, which aggravates the distress; or it appears from the first to be attended with pain in the side as a prominent symptom. Sometimes the patient has a great inclination to belch, which always gives pain. The bowels are either costive, or the patient purges bilious or dark-coloured fæces. These symptoms are more or less acute, according to the extent to which the peritoneum is affected. . . . In fatal cases the swelling and tension of the belly increase, the vomiting continues, the pulse becomes very frequent and irregular. The patient has unrefreshing slumber and sometimes delirium, but she may remain sensible to the last' (Gardiner's Medical Dictionary). The disease requires prompt and skilful treatment. The treatment, however, varies according to the form of the disease, and even in the same form various and often opposite modes of treatment are recommended by different physicians. The truth seems to be that no very definite knowledge either of the pathology or the treatment of this malady has as yet been attained. Large and frequent bleedings are often resorted to, but some think that less risk will accrue from the rational adoption of other measures, as a due recourse to calomel and opium, conjoined in the more asthenic cases with camphor, and to terebinthinate embrocations or fomentations, &c.

PUERTO-CABELLO, or Porto-Cabello, a fortified maritime town of Venezuela, in the province of Carabobo, on an island connected with the mainland by a bridge, in the Gulf of Triste, 22 miles north by west of Valencia. It is well built, has a commodious harbour, and though very unhealthy carries on a considerable trade, chiefly with the West India Islands and Europe. Pop. (1881), 10,145.

PUERTO-DE-LA-CRUZ-DE-OROTAVA, a seaport town in the Canary Islands, on the south coast of the Island of Teneriffe. It has paved and clean streets; five squares, in one of which is a pretty alameda; a town-house, a prison, an hospital, two churches, and two schools. Agriculture and rearing silkworms are the chief occupations. It was declared a free port in 1852. The anchorage is bad. Wine, brandy, almonds, cochineal, silk, barilla, are exported; and sugar, coffee, indigo, cocoa, hides, staves, oil, rice, &c., imported. Pop. 3514.

PUERTO-DE-SANTA-MARIA, a city of Spain, in Andalusia, in the province and 7 miles north-east of Cadiz, on the right bank of the Guadalete, here crossed by a bridge of boats near its mouth in the Bay of Cadiz. The houses are generally built like those of that city, but are more spacious, and have much external decoration in glass and painting, and the streets are generally broad and well paved. It has a pretty theatre; a bull-ring, where was given the grand bull-fight to the Duke of Wellington described by Lord Byron; five promenades, one of them planted with orange and other trees; infantry and cavalry barracks; a custom-house, a good edifice near the mole; a court-house; a parish church in the Gothic style; &c. Agriculture is the chief occupation, in connection therewith the preparation of wine and liqueurs for exportation. There are two soap manufactories, two of hats, one of starch, one of white-lead, seven of liqueurs, five tanneries, and four potteries. This is one of the three great towns of wine export, and rivals Jerez and San Lucar; and its vicinity to Cadiz, the centre of exchange, is favourable to business. The principal articles of import are wood and iron, chiefly for casks. Steam-boats ply regularly between the Puerto and Cadiz. Pop. 22,125.

PUERTO-PRINCIPE, an inland city of Cuba, capital of the central department, and 325 miles south by east of Havanna. From its inland position and want of water carriage the trade of this place bears no just proportion to the number of its inhabitants. Its produce, chiefly sugar and tobacco, is shipped through the Bay of Nuevitas, 40 miles north-east, by which also it receives its foreign supplies. It is the seat of the supreme court of justice for all the Spanish colonies in America. Pop. of its jurisdiction, 32,996.

PUERTO REAL, a seaport, Spain, Andalusia, in the province and 7 miles east of Cadiz. It has straight and rather broad streets; several squares, in one of which stand the town-house, prison, and public granary. It also has a church, several schools, an oratory, a poor-house, a mole, and slip; and manufactures of coarse linens, leather, pottery, vermicelli, and starch. Pop. 10,632.

PUERTO RICO. See Porto Rico.

PUFENDORF, Samuel, Baron von, one of the first and greatest expounders of natural law, publicists, and historians of Germany, was born January 8th, 1632, near Chemnitz, in the Erzgebirge, in the village where his father was a Lutheran preacher. After having studied at the school of Grimma, he

proceeded to the University of Leipzig, where he studied theology and law, and afterwards in 1657 to Jena, where he grounded himself in the Cartesian philosophy and in mathematics. Being unable to procure a situation in his native country, he accepted in 1658 the place of tutor in the house of the Swedish ambassador at the Danish court, and repaired with his pupil to Copenhagen; but a war breaking out between Denmark and Sweden, he was arrested, with the whole family of the Swedish ambassador. In this situation, which continued for eight months, he employed himself in studying the works of Grotius and Hobbes on law and government. The result of his labours appeared at the Hague in 1660 in a work entitled Elementa Jurisprudentiæ universalis. The learned elector of the palatinate, Charles Louis, to whom it was dedicated, was so much pleased with this work that he founded for the author in 1661 at Heidelberg a professorship of the law of nature and of nations, the first in Germany. Here he taught till 1670, and in addition to his professorial duties wrote his work De Statu Rei Publicæ Germanicæ, which he published in 1667 under the pseudonym of Severinus Mozambano, and which, from the hardy way in which some of the glaring imperfections of the Germanic constitution are exposed, raised a perfect storm of controversy. Partly with a view to escape the unpleasant consequences which a revelation of the authorship of the work might occasion, Pufendorf accepted in 1670 the post of professor of natural law in the university at Lund, offered him by Charles XI. of Sweden. He there wrote his work on natural law (De Jure Naturæ et Gentium, Lund, 1672), which superseded the former, and is characterized by perspicuity, method, and sound reasoning; soon after appeared the smaller compendium, or rather abstract of the above work (De Officio Hominis et Civis, Lund, 1673), which has passed through innumerable editions and been translated into several languages. Pufendorf in these works deviated still further than Grotius from the scholastic method of philosophizing, and consequently excited violent opposition. However different opinions may be respecting these works of Pufendorf, it is not to be denied that he made an epoch in the history of natural law. He had a more distinct conception than Grotius of a science which, independently of positive law or theology, should determine the rules of right solely by the laws of reason. His law of nature was a philosophical morality settling the mutual relations of justice between men, and which still remained dependent on the Christian morality. With Grotius he laid the foundation of law in the social instinct, which is nearly allied to the Christian precept of love of our neighbour, and with Hobbes he derived law from the state of fallen nature. Some years afterwards Pufendorf went to Stockholm, where he was appointed secretary of state, royal counsellor, and historiographer. There he wrote in Latin the History of Sweden from the Campaign of Gustavus Adolphus in Germany to the Abdication of Queen Christina (De Rebus Suecicis, 1676), and the History of Charles Gustavus (De Rebus a Carolo Gustavo gestis, two vols. folio, 1696), and in German his Einleitung zur Geschichte der vornehmsten Reiche und Staaten (1682, three vols.), subsequently continued by Oehlenschläger, and translated by Martinière into French. These works so much increased his reputation that in 1686 he received from Frederick William, elector of Brandenburg, an invitation to Berlin as counsellor, historiographer, and judge of the supreme court of judicature, with the charge to write the life of that prince, which he finished under the reign of his son Frederick III. In 1690 he was made privy-councillor of the Elector of Brandenburg, and in 1694 was created baron by Charles XI., king of Sweden. The works of Pufendorf, otherwise valuable, have the misfortune to be written in a very bald and uninteresting style. He died at Berlin in 1694.

PUFF-ADDER (*Vipera* or *Clotho arietans*), a serpent found at the Cape of Good Hope and in Southern Africa generally, and included in the Viperidæ or Viper family. Its popular name is derived from the fact that it possesses the power of puffing out or distending the upper part of the neck when irritated or alarmed. As in all other Viperidæ a poison apparatus exists, this form being specially dreaded on account of its highly venomous properties. The head is short, flat, and very broad. It attains a length of 4 or 5 feet. The body in some specimens may average a man's arm in thickness. The tail is tapering. The colour is darkest on the upper parts, and is of a brown tint, marked with patches of darker brown and white. A band or stripe of reddish colour exists between the eyes. The Puff-adder chiefly inhabits sandy tracts. A distinct demarcation between the head and neck is to be perceived. As in other Viperine Snakes, no pits exist in the sides of the face, and the upper jaw bears two canaliculated or perforated poison-fangs only, and is destitute of true or ordinary teeth. Several species or varieties of this form exist in South Africa. The Bosjesmen use the poison of this snake for the purpose of rendering their arrows venomous. The Puff-adder is said to be readily destroyed by the juice or oil of tobacco.

PUFF BIRDS. See BARBETS.

PUFFIN (*Fratercula* or *Alca arctica*), a genus of Natatorial Birds, included in the Alcidæ or Auk family, and thus belonging to the Brevipennate section of the order. The Puffin averages about 13 inches in length. It is the commonest of the British Alcidæ, and appears on our coasts in April and May to breed, departing southwards to Spain, Italy, and Southern Europe about August. The Puffin occurs on the northern coasts of Europe and on the eastern side of the North American continent. The beak of these birds is of large size and singularly compressed. It is deeply furrowed by three grooves on each side of the mandible. The colours of the beak also add to its singular appearance; this structure being coloured bluish-gray at its base, orange-red in the middle, and bright red at the tip. The body is short, stout, and rounded. These birds excavate burrows in sandy ground, each depositing a single egg of white colour. They are able to bite and scratch severely by means of their bills. The Puffins swim and dive with great ease; their food consisting of the smaller fishes, and chiefly the young of the sprats and herrings. They are caught and their flesh salted for food by the inhabitants of the Orkney and Shetland Islands. The Puffins occur around the Isle of Wight and off the coast of Anglesea in great numbers, but they are very generally to be met with round all the British coasts. The appearance of the bill in these birds has gained for them the popular names of 'Coulter-nets' and 'Sea-Parrots.' (Shown in Plate CLII.–CLIII. fig. 14.)

PUGATSCHEF, JEMELJAN, the son of a Cossack, born at Simoweisk, a village on the Don, in 1726, played for a short time an important part in Russia. War and robbery were the employments of his youth, and he became the leader of a predatory band. He afterwards entered the Prussian service during the Seven Years' war; then joined the Austrians, served against the Turks, and was present at the siege of Bender (1770). Returning to his native country, he attempted to sow the seeds of rebellion among his countrymen, but was soon arrested and confined at Kasan. Having made his escape,

he was joined by some restless spirits, and was encouraged, by his personal resemblance to the lately deceased emperor, Peter III., to attempt to pass himself off for that emperor. The insurrection began in the middle of August, 1773, when a manifesto was issued in the name of the pseudo Peter. The number of his followers, which was at first only nine, had increased in September to 300. He was everywhere joined by his countrymen and the peasantry, to whom he promised deliverance from their oppressions. His force was increased by 500 deserters from the garrison of Jaizkai and many Roskolnicians (which see), and he took several fortresses, practising the most shocking cruelties. His army now amounted to 16,000 men, and was gaining strength by the concourse of Bashkirs, Wotiaks, Tartars, &c. He captured Kasan, the old capital of the empire, and passed the Volga. He was at length defeated at the moment that Moscow was threatened, betrayed by his followers to Suwaroff, and (June 10, 1775) executed, together with the other rebel leaders, at Moscow—the only instance of capital punishment in the reign of Catharine. With his death terminated a rebellion which cost more than 100,000 lives.

PUGET SOUND, an extensive inlet on the west coast of North America, in Washington territory. It is interspersed with numerous islets, and forms the south portion of Admiralty Inlet, which communicates on the north with the Pacific through San Juan de Fuca Strait.

PUGILISM. See Boxing.

PUGIN, Augustin Northmore Welby, son of Augustus Pugin, was born in 1811, and under the instructions of his father, combined with a native enthusiasm, early displayed wonderful skill and facility in delineating architectural scenes and remains. One of his first employments was acting as assistant to the Grieves in painting the architectural displays for the performances at Covent Garden and Her Majesty's Theatre. His taste for Gothic art was next turned to account in designing the furniture for Windsor Castle, and in supplying Messrs. Rundell and Bridge with designs for mediæval plate. As one of the results, perhaps, of his ardent enthusiasm for mediæval art, he became a convert in 1834 to Catholicism, and devoted himself thenceforth to the illustration and revival of Gothic architecture in connection with the Romish Church. His treatises on Gothic Furniture and Iron Work appeared in 1835, and attracted considerable attention. In the following year he gave to the world a work entitled Contrasts, or a Parallel between the Noble Edifices of the Fourteenth and Fifteenth Centuries and similar Buildings of the Present Day, in which he expressed in no measured terms his views as to the present state of ecclesiastical architecture. Other works of Pugin were The True Principles of Pointed or Christian Architecture, published in 1841; An Apology for the Revival of Christian Architecture (in 1843); and a magnificent chromo-lithographic work, The Glossary of Ecclesiastical Ornament, published in 1844. Meantime his talents as a practical architect were actively employed, though it is somewhat remarkable that they were almost exclusively devoted to the construction of Roman Catholic places of worship. He was employed by Sir Charles Barry in the internal decoration of the houses of Parliament, and was connected with Mr. Hardman of Birmingham in the manufacture of the renowned Gothic brass-work, besides having a share in the manufactory of stained glass in the same town. Latterly his intellect gave way, overtasked by the incessant excitement and labour to which it was subjected, and he was obliged to be removed to a lunatic asylum. He temporarily recovered, but only for a very short time, and expired at Ramsgate on 14th September, 1852.

PUGIN, Augustus, a distinguished architectural draughtsman, was born in 1769 in France, but settled early in life in London, where for many years he acted as assistant to the celebrated architect Nash. He afterwards supported himself by executing architectural drawings for engravers, and made the drawings of the buildings in Ackerman's Microcosm of London, first published in 1808. He was also the artist employed on a Series of Views in Islington and Pentonville, with Descriptions by E. W. Brayley. After this he began to devote his attention to mediæval architecture, and published between 1821 and 1823 a work in two volumes, entitled Specimens of Gothic Architecture selected from various Ancient Edifices in England. A work was then undertaken by him in conjunction with the celebrated John Britton, and Architectural Illustrations of the Buildings of London made its first appearance in 1824, and was completed in two quarto volumes. His chief production, in which Mr. Britton also co-operated, was Specimens of the Architectural Antiquities of Normandy, published between 1825 and 1828. The last works of Mr. Pugin were drawings for a publication entitled Paris and its Environs Displayed, and Gothic Ornaments selected from various Buildings in England and France. He was aided in the last by his son Augustin Pugin. He died on 19th December, 1832.

PULCI, Luigi, an Italian poet, born at Florence in 1431, was the youngest of three brothers distinguished for their talents and learning. Of the circumstances of his life we know nothing but that he lived on terms of intimacy with Lorenzo de' Medici and Poliziano. His burlesque epic poem Il Morgante Maggiore, in which he relates the adventures and exploits of Rinaldo and the giant Morgante, is said to have been written at the suggestion of Lorenzo's mother, and to have been read as an entertainment at table. This poem, in twenty-eight cantos, is a clever parody on the chivalrous romances of the Carlovingian period, which, invented by the French Trouvères, had been imitated by several of the Italian poets. Sometimes, however, forgetting the express object of his work, the poet delivers himself of passages of great pathos, in which he shows himself to be possessed of genuine poetic feeling. One feature of this poem is the skilful introduction of many of the Tuscan idioms, which furnishes us with one of the most valuable sources for gaining a knowledge of the early Tuscan dialects. Pulci cannot bear a comparison with Ariosto and Tasso; he cannot be denied to possess fancy, but he wants taste and judgment. His mixture of the grave, lofty, and sacred with the mean and burlesque, which is offensive to modern taste, was in accordance with the spirit of his age. This work of Pulci's was translated into English by Lord Byron. Pulci died in 1487 or 1488. —His brother Bernardo was the author of some elegies and short poems.—Another brother, Luca, wrote heroic epistles, a pastoral romance (Driedeo d'Amore), and an epic romance, probably the first in Italian (Il Ciriffo Calvaneo).

PULCINELLO. See Punchinello.

PULLEY, a mechanical power. It consists of a circular disc of wood or metal, which has freedom to turn about an axis passing through its centre; it has a groove round its edge to prevent a cord from slipping off. If the axis is supported by a beam, or is in any way fixed in space, the pulley is said to be 'fixed.' A fixed pulley merely changes the direction of a pull in a cord, it gives no mechanical advantage. The pulleys in Pl. CXXIII. and CXXIV., figs. 10, 12, and 19, fig. 13 on the right-hand side, fig. 14 the last

to the right, fig. 15 the three above, are all fixed pulleys. All the other pulleys shown are movable —that is, their axes are not fixed. In fig. 11 a weight is suspended from the axle of the pulley; of this weight and the weight of the pulley itself one-half is supported by the beam, and only one-half by the hand; hence a single movable pulley has a mechanical advantage = 2. Instead of pulling directly upwards with the hand, it is customary to have the cord passing round a fixed pulley, as in fig. 13, so that the power may be a downward pull. By combining a number of movable pulleys a mechanical advantage may be obtained, depending on the mode of combination. Neglecting friction, the mechanical advantage may be calculated from the principle of 'virtual velocities;' but friction is usually very considerable in the pulley, and if it has to be taken into account in calculation special experiments must be made to suit the case in hand. The principle of 'virtual velocities' or of 'equal works' is that the power applied to a machine multiplied by the distance through which the point of application moves in a certain time in the direction of the power, is equal to the resistance overcome by the machine multiplied by the direct distance through which it is overcome. That is, the work done by the power is equal to the work done against the resistance or weight. Applying this principle to fig. 14, where the three movable pulleys are separate, and have separate strings, each string being attached at one end to a beam, passing round a pulley, and being attached at the other end to a second pulley, we find that if we take half the sum of the weight and bottom pulley we have the pull in the bottom string; add this pull to the weight of the next pulley, and take half for the pull in the next string; and so on. In fig. 15 a block containing three pulleys is fixed to the beam; a movable block containing three pulleys supports the weight; a string passes round all the pulleys, one end being attached to the fixed block, and at the other the power is applied. It is evident that when the power moves through 6 inches the blocks approach each other by the distance of 1 inch, and hence the mechanical advantage is six. In every case of this, which is the most common, combination of pulleys, the power is equal to the sum of the weight and of the movable block divided by twice the number of pulleys in the movable block. In these examples we have supposed the straight parts of the strings to be parallel to one another, and that no work is done against friction. When the cords are not sensibly parallel the mechanical advantage may still be calculated by applying the principle of virtual velocities. The amount of work lost in friction and in bending the string can only be determined from special experiments. The work lost in friction is nearly proportional to the weight lifted.

PULMONARIA, or PULMONIFERA, a term applied to groups of organisms which breathe air directly from the atmosphere, and respire by means of lung-sacs or analogous organs. The Pulmonaria or Pulmonary Arachnidans form the highest division of the class Arachnida, and are represented by Spiders and Scorpions. They breathe by lung-sacs, each of which consists of an involution of the skin or integument, constituting a sac-like cavity in the side of the body, and to which air is admitted by apertures known as *stigmata* or *spiracles*. The pulmonary sacs contain a number of delicate plate-like structures or *lamellæ*, closely set together like the leaves of a book, which serve to support the ramifications of the minute blood-vessels, and so increase the respiratory area. In the Spiders, &c., *tracheæ* or breathing tubes similar to those of insects may be conjoined with the pulmonary sacs.

The term Pulmonaria is also applied to indicate one of the two main sub-classes into which the class of Gasteropodous Mollusca (see GASTEROPODA and MOLLUSCA) is divided. The name *Pulmo-Gasteropoda* is sometimes also used synonymously with Pulmonaria. In these Pulmonary Gasteropods, represented by the Snails and Slugs, respiration is performed by means of lung-sacs. These sacs are formed by a folding or inflection of the 'mantle' (which see), which thus forms a kind of chamber, to which air is admitted by a special aperture which can be opened or closed at the will of the animal. This chamber is usually placed towards the back or dorsal aspect of the animal, its aperture opening (as in Slugs) on the right side of the body near the neck. The roof and walls of this chamber are richly supplied with capillary blood-vessels, into which the blood destined for purification is sent. The floor of the chamber consists of a kind of muscular *diaphragm* or 'midriff,' by means of which the air can be expelled, or the dimensions of the chamber enlarged so as to admit a fresh supply of the aerating medium. See also MOLLUSCA, LUNG, &c.

PULMONARY CONSUMPTION. See CONSUMPTION.

PULO PENANG. See PENANG.

PULPIT (Latin, *pulpitum*), the elevated inclosure or desk in a church from which the preacher is wont to deliver his discourse and conduct other religious exercises. The term was also applied to the moveable desk from which disputants pronounced their dissertations and authors recited their works; and in the ancient Roman theatres it designated the front part of the stage, where the actors performed their parts. The *ambo* or *pulpitum* of the early Christians appears to have been applied to a different purpose from that for which the modern pulpit is used; it was the place from which parts of the service were sung or recited, and was large enough to contain several chanters. This use of it, however, was gradually superseded, as it came to be considered a convenient place from which the minister might deliver his homily. The pulpits of St. Lorenzo fuor delle Mura and St. Clemente at Rome are supposed to be the oldest now existing. The pulpit was long regarded as an architectural feature of the building, constructed sometimes of marble, but oftener of the same material as the building itself; and it frequently exhibited great elaborateness of structure. As a work of art one of the most celebrated pulpits is that in St. Gedule's at Brussels; it is made of oak, elaborately carved, and is supported by figures representing Adam and Eve expelled from paradise. Stone pulpits used to be common in the courts and cloisters of religious houses, and under the appellation of *preaching-crosses* they were also used for preaching in the open air, of which Paul's Cross furnishes a famous example.

PULQUE, or OCTLI, a favourite drink of the Mexicans, extracted from the maguey, or *Agave Mexicana*. At the moment of efflorescence the flower-stalk is cut out, and the juice destined to form the fruit flows into the cavity thus formed, and is taken out two or three times a day for four or five months. The sap in this state is called *aguamiel* (honey-water), and when allowed to ferment slightly forms an agreeable drink. The natives, however, prefer it after undergoing a further process of fermentation, in which state it is acid, and has a putrid kind of smell. When allowed to ferment still more it turns into vinegar, and when boiled down becomes syrup. Pulque brandy is made of it; and when water and sugar are mixed with the sap, and the whole allowed to ferment a few hours, the drink is called *tepache*.

PULSE, a general term applied to the pods or seeds of leguminous plants, such as pease, beans, lentils, &c. Good pulse is very nutritious, though not easy to digest.

PULSE (from the Latin *pulsus*, a beating, a blow), the motion of an artery, consisting of its alternate expansion and contraction, which in practice is considered as a beating. This motion is strongest in the heart, which is the centre of the arterial system, and from it is propagated through all the minutest branches of the arteries. In those which lie immediately under the skin it can be felt with the finger, as is the case with the radial artery, the pulsation of which is very perceptible at the wrist. (See BLOOD and HEART.) The state of the pulse is therefore an indication of the action of the heart and the whole arterial system, and of the condition of the blood and the physical functions in general. The circumstances to be attended to in the pulse are either the number of pulsations which take place in a given time, and the regularity or irregularity of their occurrence, or the character of each pulsation. In the former case the pulse is said to be quick or slow according to the number of pulsations in a given interval; regular or irregular, as they occur at equal or unequal intervals. In the latter case it is strong or weak, hard or soft, full or small, &c. It is affected by the age, sex, and temperament of the individual, and by accidental circumstances, as sleep, food, exercise, heat, &c. The pulse is most rapid in childhood, making from 100 to 110 beats in a minute, and is regular, and rather soft and small. In youth it is much less rapid, making not far from ninety beats a minute. At this period it is regular, strong, rather soft than hard, moderately full. In mature age the number of beats is about seventy-five per minute, and the pulse is regular, strong, or moderate, fluctuating between hard and soft, between full and small. In old age the number of beats sinks to sixty. The pulse is sometimes irregular, strong, but slow, hard, rather full than small. In the female sex it is more rapid, softer, and smaller than in the male. In the sanguine temperament (so called) it is quicker, fuller, softer; in the choleric, slower, harder, stronger; in the phlegmatic, slower, weaker, softer, fuller; in the melancholy, slow, hard, and strong. A vegetable diet makes it slow, weak, full, soft; a meat diet, spices, spirituous liquors, make it quick and hard. In a pure, clear air it is quick; in damp, impure air, slow and languid. Sudden agitation and violent passions make it rapid and irregular; joy makes it quick and strong; long-continued grief, languid and soft. The pulse is, therefore, a highly important indication of the state of the system. A deviation from the regular pulse of an individual indicates a disordered state. When the irritability of the system is so heightened as to produce fever or inflammation the pulse is accelerated. If the action of the nervous system is irregular, or unduly heightened, the pulse becomes frequent and irregular, as in the case of cramps and a diseased irritation in the abdomen, from worms, &c., and in hypochondriacal and hysterical persons. In case of mechanical obstructions to the circulation, as in dropsy of the pericardium, polypus in the heart or in the great arteries, the pulse is irregular and interrupted. It is doubtful whether Hippocrates had any knowledge of the pulse. Soon after his time, however, physicians, especially those of the Alexandrian school, were attentive to it. Aretæus of Cappadocia explained the pulsation as a motion occasioned by a natural and involuntary extension of the warmth belonging to the heart and arteries, by which their own motion is occasioned; and Athenæus of Cilicia had given the same explanation before him. He describes the various kinds of pulse connected with different disorders. Galen wrote several works on the pulse. For several centuries after the doctrine of pulsation remained much as he had left it, as was the case, indeed, with many branches of medical science. The demonstrations of the circulation of the blood by Harvey, and of the irritability of the muscular fibre by Haller, threw new light on this subject. The feeling of the pulse is the principal examination which Chinese physicians make of the state of their patients, and they discriminate its different states with a minuteness bordering on absurdity.

PULTAWA. See POLTAVA.

PULTUSK, a town of Russian Poland, in the government of Lomza, partly on the right bank and partly on an island of the Narew, 32 miles N.N.E. of Warsaw. It has three churches, a synagogue, a convent of the Sisters of Mercy with an hospital, several old monasteries, a gymnasium, and a castle; a distillery, and some general trade. The Saxons were here defeated by Charles XII. in 1703, and the Russians by the French in 1806. Pop. 7689.

PUMA, or COUGAR (*Felis* or *Leopardus concolor*), a species of Carnivora, limited in its distribution to the American continent, and inhabiting Brazil, Paraguay, Guiana, Mexico, and the United States. It has sometimes been termed the 'American Lion,' but it has more the general appearance and conformation of an Old World lioness. Its colour is a uniform fawn or reddish-brown, without spots or markings of any kind. It may attain a length of 9 feet, inclusive of the tail. In habits it is stealthy and cowardly, and seldom or never openly attacks man. At the same time it is much dreaded in its native regions from its insidious mode of attack and from its ravages on domestic animals. The early settlers of the United States lost numerous children and even adults from the attacks of these animals. The Puma appears to kill many victims in a herd of sheep or cattle before it begins to feed. It climbs trees with facility, and is exceedingly lithe and active, making bounds and leaps of considerable extent. This animal appears, notwithstanding its ferocious disposition, to be in some cases susceptible of a high degree of domestication. It is said to become fondly attached to its master; and it is related that Kean the actor thus possessed a puma, named 'Tom,' which followed him like a dog in the most crowded assembly.

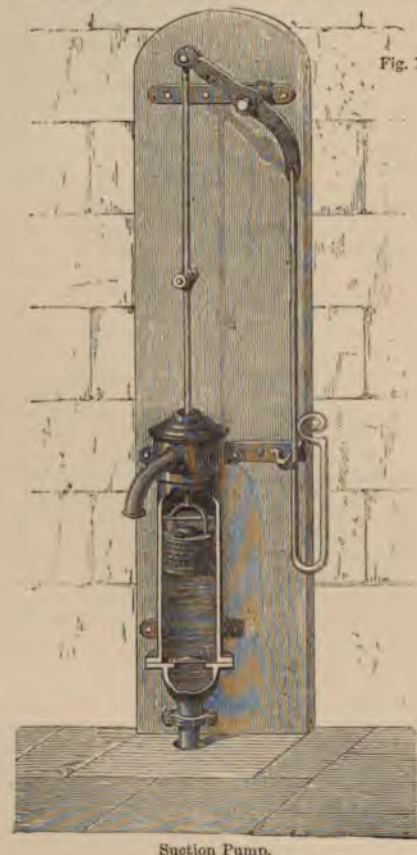
The fur of these animals is thick and closely set, and is lightest on the outer aspects of the limbs and on the belly, whilst the breast generally approaches a white colour. The young Puma may show faint stripes on the face and flanks, but these markings totally disappear in the adult. The females are of somewhat smaller size than the male animals.

PUMICE, a variety of felspathic lava found only in volcanic regions. It contains about 60 per cent. of silica, with alumina, iron, lime, soda, &c. It is of a whitish-gray colour; sometimes it is yellow-brown or even black. It is very porous and also fibrous in structure, and its specific gravity is less than that of water, so that it swims in that fluid. Its extreme roughness makes it very useful for polishing; in the solid state it is used to polish wood, paint, &c.; and when pulverized as a polishing powder for glass, bone, ivory, marble, metals, &c. The pumice-stone is supposed to be produced by the action of aqueous vapour or gases on materials melted by volcanic heat. A variety of pumice which presents a less fibrous or tumefied appearance is called *obsidian*.

PUMP, a contrivance for raising liquids or for removing gases from vessels. (See AIR, ATMOSPHERE, HYDROSTATICS.) The operation and the construction of the air-pump are explained in a separate article. There are three kinds of pumps in common use for raising water, of all of which there are various modi-

fications. The simplest and most common pump is the ordinary suction pump. It is of great antiquity, its invention being ascribed to Ctesibius of Alexandria, who flourished about 250 B.C. Fig. 1 shows the most common construction. This pump consists of a hollow metal cylinder, which contains a piston stuffed so as to move up or down in the cylinder easily and yet be air-tight. This piston is pulled and pushed up and down by means of the rods, lever, and handle, shown in the figure. In the piston there is a valve which opens upwards, and at the bottom of the cylinder there is another valve, also opening upwards, which covers the orifice of a tube fixed to the bottom of the cylinder, and reaching to the well from whence

Fig. 1.

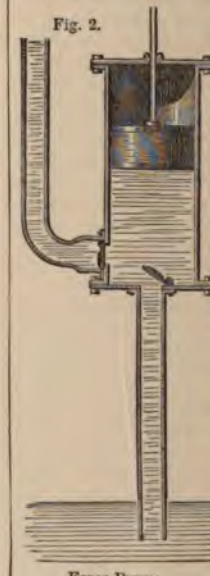


Suction Pump.

the water is to be drawn. This tube is commonly called the *suction* tube, and the cylinder the *body* of the pump. At first when the piston is at the bottom of the cylinder there can be no air, or at least very little, between it and the bottom valve, for as the piston was pushed down the valve in it would allow the air to escape instead of compressing it. When it is drawn up the pressure of the air shuts the valve, and there is a partial vacuum produced in the body of the cylinder and the suction tube when the piston arrives at the top. But the air in the cylinder and suction tube being very much rarefied, its pressure will be greatly less than that of the external atmosphere on the surface of the water in the well; therefore the water will be pressed up the suction tube. A repetition of the operation causes greater rarefaction of the air, and at length water fills the body of the pump, after which time a volume of water is lifted at every stroke equal to the size of a cylinder whose base is the sectional area of the pump, and whose height is the play of the piston. During the down stroke the water merely passes through the piston, and is not lifted, and hence this pump is said to be single-acting. Although the height of the piston above the water surface in the well must never exceed 33 feet, the water, after passing through the piston valve, may evidently be lifted to any height we please.

The 'lifting pump,' like the suction pump, has two valves and a piston, both opening upwards; but the valve in the cylinder instead of being placed at the bottom of the cylinder is placed in the body of it, and at the height where the water is intended to be delivered. The bottom of the pump is thrust into the well a considerable way, and if the piston is supposed to be at the bottom, it is plain that as its valve opens upwards there will be no obstruction to the water rising in the cylinder to its height in the well; for by the principles of hydrostatics water will always endeavour to come to a level. Now when the piston is drawn up its valve will shut, and the water in the cylinder will be lifted up; the valve in the barrel will be opened, and the water will pass through it and cannot return as the valve opens upwards;—another stroke of the piston repeats the same process, and in this way the water is raised from the well: but the height to which it may be raised is not in this as in the suction pump limited to 32 or 33 feet.

Fig. 2.

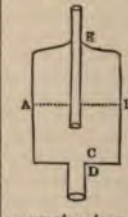


Force Pump.

In the 'force pump' the piston has no valve, but there is a valve opening upwards at the top of the suction pipe, and there is another valve at the bottom of the cylinder opening outwards into the pipe which conveys the water from the pump. When the piston is raised the suction-pipe valve opens, and a partial vacuum being produced, the water is pressed by the atmosphere into the pump on the principle of the suction pump. But when the piston is pressed down the valve of the suction pipe shuts, the valve which leads into the ejection pipe opens, and the water is forced up the tube. When the piston is raised again the ejection valve shuts and the suction valve opens. The same process is repeated, and the water is thrown out at every descent of the piston, the discharge therefore is not constant.

It is frequently required that the discharge from the pump should be continuous, and this is effected by fixing to the top of the eduction pipe an air vessel (fig. 3). This air vessel consists of a box A B, in the bottom of which there is a valve at C opening upwards into the box. This valve covers the top of the eduction pipe D. A tube, E, is fastened into the top of the box, reaching nearly to the bottom of it; it rises out of the box, and is furnished with a stop-cock. If the stop-cock be shut, and the water be sent by the action of the pump into the air vessel, it cannot return, in consequence of the shutting of the valve C; and because of the space occupied by the

Fig. 3.



water the air in the box is compressed, and will therefore exert a pressure on the water in the air vessel. If the water fill three-fourths of the box, then the air will be compressed so as to exert four times the pressure that it did while the box or air vessel remained empty of water, and will, therefore, according to the law of Mariotte, force the water up the tube E, and the result will be that a continuous jet will issue from the upper orifice of that tube.

The fire-engine (which see) consists of two forcing pumps, working into one common air vessel placed between them, and from which the spouting pipe for directing the water proceeds. 'Double-acting' pumps are often employed for household purposes. They consist of a pump barrel V V (fig. 4), with four openings in it, A A′ B B′. The openings A and B′ are in communication with the suction tube C; A′ and B are in communication with the ejection tube C′. The four openings are fitted with four valves opening all in the same direction, that is from right to left, whence it follows that A and B′ act as suction valves, and A′ and B as ejection valves, and consequently in whatever direction the piston may be moving the suction and ejection of water are taking place at the same time. The chain pump used in the navy is an upright barrel, through which leathers strung on a chain are drawn by means of wheels or drums, in constant succession, carrying the water in a continual stream before them. They are employed only when a large quantity of water is to be raised, and must be worked rapidly.

Double-action Pump.

Centrifugal pumps are now universally employed wherever the lift is not too great and the quantity of water is considerable. The principle of their action is that when a mass of matter is set in rotation its particles tend to fly off from the centre of rotation. A wheel, shaped like an ordinary fan, has passages leading from its centre to its circumference; it is made to rotate very rapidly in a casing; its circumference communicates with a delivery pipe, and its centre with a pipe leading to the water which is to be pumped. There is a constant flow from centre to circumference of the wheel; the water from the well is sucked up to the centre of the wheel, and leaves the circumference by the eduction pipe.

PUMPERNICKEL, the name given to a coarse brown bread made in Westphalia (more especially in the districts of Münster and Osnabrück) from unbolted rye. It is baked in large square loaves, which often weigh as much as 60 lbs. Its proper manufacture depends upon the treatment of the dough, which must contain neither yeast nor leaven, and also on the management of the oven, in which the batch must remain from twelve to fourteen hours. Pumpernickel is rarely an article of commerce, though as a national product it is frequently sent to foreign countries in presents. It possesses an agreeable taste, arising from the aroma peculiar to the bran of rye.

PUMPKIN, or POMPION (*Cucurbita Pepo*), a species of gourd, or squash, distinguished from most varieties of the latter by the rounded form of the fruit, which sometimes grows to an enormous size. It has hispid, branching, and prostrate stems, which in good soil will cover an eighth part of an acre. The fruit is esteemed inferior to most varieties of the squash, but, notwithstanding, it is very commonly cultivated, both in Europe and America.

PUN, a play upon words, the wit of which depends on a resemblance between two words of different and perhaps contrary significations, or on the use of the same word in different senses; as in the well-known story of the man who, being requested to make a pun, asked for a subject, and was told to take the king, upon which he replied that the king was no subject. The Greeks and Romans sometimes used puns even in serious discourses; but the moderns restrict them to light conversation, devices, symbols, rebuses, mottoes, &c.

PUNCH, an intoxicating beverage much more used formerly than in the present day; the various ingredients of which it is composed are spirits, water, lemon-juice, and sugar, with occasionally an addition of some spice, as nutmeg or cinnamon. These are usually mixed in the requisite proportions in a large china bowl made for the purpose—hence called the punch-bowl. The most usual form of the beverage is compounded as follows:—Squeeze the juice out of three or four lemons into a jug, adding thereto the peel of one lemon cut in slices, 12 oz. of lump-sugar, and 3½ pints of boiling water; infuse this mixture for half an hour, then pour into the punch-bowl, and add of rum and brandy rather less than a pint of each. Varieties of punch are called after their principal ingredient, gin, iced, milk, orange, raspberry, tea, wine, &c. Punch was introduced into this country from India, and is so called from the Hindu *panch*, five, which is the usual number of the ingredients.

PUNCH, a tool used for making holes in wood, malleable metal, or other materials, by cutting out the piece; and it is thus distinguished from the drill. It cannot be applied to cast-iron or bronze, being in that case liable to break or produce a ragged edge. Besides the simple hand-tool there is also a punching machine. The machine consists of a strong frame, at the front of which is a broad slide, moved vertically up and down by an eccentric fixed on the end of a shaft passing lengthwise through the frame; on this shaft there is a large wheel, which receives motion from a pinion on another shaft carrying the fly-wheel and driving-pulleys. The punches are fixed in the lower end of the vertical sliding-piece, and immediately under them is fixed a piece of steel called the dies, which has holes in it to correspond to the punches. The plate in which holes are to be punched is fastened upon a travelling table in front of the machine; and the slide being up, and the surface of the table level with that of the dies, the part where the holes are to be punched is placed between the punches and the dies, so that when the machine is set in motion the punches are forced through the plate by the action of the eccentric, and the pieces driven out fall through the holes in the dies.

PUNCH AND JUDY, a well-known puppet-show frequently exhibited in the streets. The show of 'Punch and Judy' is much more recent in its origin than the Neapolitan Punchinello. (See PUNCHINELLO.) The earliest account of the adventures of Punch and his wife Judy is found in a ballad the date of which does not appear to be anterior to 1795. This account is pretty closely adhered to in the representations we are accustomed to see in our streets. The show embodies a domestic tragedy, followed by a supernatural retribution, the whole of which is treated in a broadly farcical manner. Punch himself is represented as short and thick-set, with an

immense hump upon his back, a wide mouth, long chin, and hooked nose, and wearing a three-pointed cap. His wife Judy, who is in some respects his counterpart, and his dog Toby, are important characters in the performance.

PUNCHEON, a liquid measure of capacity containing one-third of a tun, or 84 gallons.

PUNCHINELLO (from *pulcinello*), an Italian mask. The Abbate Galiani derives the name from a misshapen but humorous peasant from Sorento, who had received it (about the middle of the seventeenth century) from his bringing chickens (*pulcinelle*) to market in Naples, and who, after his death, was personated in the puppet-shows of the San Carlino theatre, for the amusement of the people, to whom he was well-known. According to another account, a company of actors, which went to Acerra at the time of the vintage, was attacked by the peasants (with whom the vintage is a season of festivity) with a sally of jokes and gibes, in which a certain Puccio d'Aniello among the peasants attracted notice by his comical humour and grotesque appearance, being hunched before and behind. The players had to yield to him; and when the contest was over they determined to take advantage of the talent of Puccio d'Aniello, and persuaded him to join their company. He appeared on the stage in a white robe, and large, full shirt, with long hair, and soon became such a favourite of the Neapolitans that his mask was retained after his death; and his successor, to resemble him the more, chose a mask with a long black nose. From his name was formed, according to Neapolitan custom, *Pulcinello*. Perhaps, however, this mask was only a modification of an older one, which some have derived from the ancient *Atellanæ fabulæ* (which see), and have thought that they discovered the grotesque figure of Punch on ancient vases. This mask is still the delight of the Neapolitans.

PUNCTUATION, the art of employing certain signs, by means of which the parts of a discourse are connected or separated, as the sense requires, and the elevation, depression, or suspension of the voice indicated. Punctuation serves both to render the meaning intelligible, and to aid the oral delivery. A fully developed system of punctuation is peculiar to the modern languages of Europe. The Romans were, indeed, acquainted with the term, but with them it had a totally different signification. Their points, as well as those of the Greeks, were almost entirely oratorical, that is, confined to the delivery and pronunciation of the words; and there were often no points, or at most only one at the end of a sentence, or pauses were indicated by breaking up the matter into lines or paragraphs (*stichoi*). Modern punctuation, which is, for the most part, grammatical, is of a later origin, and the invention has been attributed to the Alexandrian grammarian Aristophanes, who flourished in the second century, after whom it was improved by succeeding grammarians. But as no particular rules were followed in the use of these signs, punctuation was exceedingly uncertain until the end of the fifteenth century, when the learned Venetian printers, the Manutii, increased the number of the signs, and established some fixed rules for their application. These were so generally adopted that we may consider them as the inventors of the present method of punctuation; and although modern grammarians have introduced some improvements, nothing but some particular rules have been added since that time. The principal points used in English composition are the *comma* (,), *semicolon* (;), *colon* (:), *period* or *full stop* (.), *note of interrogation* (?), *note of exclamation* or *admiration* (!), *dash* (—), and *parenthesis* ( ). Of these the first four are grammatical points indicating the length and character of the pauses to be made in reading; the others are mainly rhetorical or syntactical aids regulating the modulation of the voice rather than its suspension, but the notes of interrogation or admiration may take the place of any point of the former class, according to the structure of the sentence, and the dash partakes of both characteristics. No rules for punctuation can be laid down that will meet every case, the structure of sentences being so various. In general it may be said that the *comma* marks the smallest grammatical division in a sentence, separating the several members of a series, also the subordinate clauses from the main clause, and the like. The *semicolon* indicates a longer pause than the comma, but requires another member or members to complete the sense. The *colon* denotes a still longer pause, and may be inserted when a member of a sentence is complete in itself, but is followed by some additional remark or illustration of the subject. The *period* indicates the end of an assertive sentence, and is also used after contracted words, after headings, titles of books, &c., and generally after Roman numerals. The *note of interrogation* is placed at the end of an interrogatory sentence: the Spanish place it before as well as after such a sentence. The *note of exclamation* or *admiration* is placed at the end of such words or clauses as indicate strong emotion. The *dash* is employed where a sentence breaks off abruptly and the subject is changed; where the sense is suspended, and is continued after a short interruption; where there is an unexpected or epigrammatic turn in the sentiment; after a series of clauses leading to an important conclusion; and in certain cases to indicate an ellipsis. The *parenthesis* incloses a word or phrase introduced into the body of a sentence, with which it has no grammatical connection. These points do not indicate all the pauses to be taken in reading. There are many cases in which a pause should be made where there is no point, but the consideration of this subject belongs to elocution.

PUNDIT. See PANDIT.

PUNIC (from *Pœni*, Phœnicians), an epithet originally synonymous with *Phœnician*, but in classic usage equivalent to Carthaginian, Carthage being a Phœnician colony.—*Punic wars*, wars waged between Rome and Carthage. The first of these wars broke out in B.C. 264, and was not brought to a termination till B.C. 241; the second lasted from B.C. 218 to B.C. 202; and the third, which ended with the destruction of Carthage, from B.C. 149 to B.C. 147. (See our articles on ROME, CARTHAGE, HANNIBAL.)—*Punic faith* (*fides Punica*), among the Romans a proverbial expression for faithlessness.

PUNISHMENT, a term derived, through the French *punir*, from the Latin *punire*, which is connected with *pœna*, satisfaction, compensation. Originally it signified pain inflicted on or endured by a person as a satisfaction or atonement by him for some offence which he had committed; it embodied, in fact, the idea of retaliation, and this appears to have been the earliest notion of punishment which most nations of which we have any record possessed. It occurs amongst the early Greeks; the Romans recognized it in the laws of the Twelve Tables; and it was the principle of the well-known provision of the Mosaic law, 'an eye for an eye,' &c. (Exod. xxi. 24). This view of punishment, however, which makes it merely equivalent to vengeance, has been superseded among Christian nations by one which accords better with the spirit of Christianity, which is that the proper end of punishment is not so much to avenge past, as to prevent future offences. In this country punishment by death is called *capital* punishment; other modes of punishment are called *secondary*. The latter vary in severity according to the estimated

magnitude of the offence. The crimes for which capital punishment is now inflicted have been reduced to the following, namely, treason, murder, attempt to murder, accompanied with actual injury to the person; the burning of buildings or ships, with danger to human life, and under defined circumstances; piracy, accompanied with acts endangering life; burglary, aggravated by cruelty or violence to an inmate; robbery, aggravated by personal violence; holding out false lights, with the intention of causing the shipwreck of any vessel in distress; and lastly, sodomy. Sentence of death may be commuted by the sovereign into penal servitude for life. Secondary punishments are of two kinds, imprisonment, with or without hard labour, for a greater or less period, and the infliction of fines of varying amounts for certain of the minor offences.

PUNJAB, more properly PANJAB (the '*Five Waters*'), an extensive territory in the north-west of Hindustan, formerly under the dominion of the Sikhs, but since February, 1849, attached to the Presidency of Bengal, in British India, and so called from its position, being intersected by the Indus and the four great rivers which unite to pour their waters into it. There are in reality five rivers besides the Indus, but the Bias being much smaller than the others seems to have been neglected when the name was given. Some authorities, however, leave out the Indus as one of the five, and take in the Bias instead. The present lieutenant-governorship of the Panjab, however, is larger than the Panjab proper, and is bounded on the west by Afghanistan, from which it is separated by the Suleiman and other mountains; on the north by Kashmir; on the east by the North-west Provinces, the Ganges forming a large portion of the boundary; and on the south by Rajputana. The area, exclusive of native states, is 106,632 square miles; the pop., according to the census of 1881, 18,850,437; inclusive of native states, the area is 142,449 square miles, and the pop. 22,712,120. The Panjab is divided into the ten divisions of Ambala, Amritsar, Delhi, Derajat, Hissar, Jallandar, Lahor, Multan, Peshawur, and Rawalpindi. Lahor is the capital.

General Description.—Its extreme northern portion is rendered mountainous by spurs, or offsets of the great Himalaya system; but with these exceptions the surface is for the most part an extensive plain, gradually sloping from the north-east to the south-west, in the direction of the six rivers by which it is so abundantly irrigated. These rivers (proceeding from west to east) are the Indus, the Jhilam (ancient, *Hydaspes*), Chenab (ancient, *Acesines*), the Ravi (ancient, *Hydraotes*), the Bias (ancient, *Hyphasis*), and the Satlej (ancient, *Hesudrus*). The Jhilam and Chenab unite their waters, and then are joined by the Ravi, the united stream is then augmented by the Satlej, which has previously received the Bias. The combined waters of these rivers form the Panjnad, which joins the Indus near Mithankot. The rivers of the Panjab divide it into five districts, or *doabs* (countries between two rivers), namely, the Sind-Sagar Doab, between the Indus and Jhilam; the Jech Doab, between the Jhilam and Chenab; the Rechna Doab, between the Chenab and Ravi; the Bari or Manja Doab, between the Ravi and Bias; and the Jallandar Doab, between the Bias and Satlej. Of these the first is by far the largest, but also the most sterile and least inhabited, abounding with bare eminences and rugged decilvities, interspersed here and there with rich and fertile valleys. The second doab is mostly level, and described by Burnes as 'a sterile waste of underwood,' the abode of shepherds, and scantily irrigated; the Rechna Doab is bare and neglected, though susceptible of high cultivation; the Bari Doab, though bare, has a large surface under cultivation, and is the most populous and important of all, containing the large towns of Amritsar, Multan, and Lahor; while the Jallandar Doab is highly cultivated, well peopled, and excelled in climate and productions by no province in India. The Sikhs allowed almost the whole country to fall into a state of extreme neglect.

Geology, Soil, and Climate.—The upper regions close to the Himalaya present occasional beds of compact limestone, sandstone, gypsum, and red clay, and containing all but inexhaustible beds of salt, particularly that mountain chain specially termed the 'salt range,' in the north-west. Gold is found in the beds of the Indus and Chenab. Iron, plumbago, antimony, alum, and sulphur are found in the hill country; nitre is obtained abundantly in the alluvial plains, and coal-beds exist on the left or east bank of the Indus. The soil of the level country varies remarkably from stiff clay and loam to sand, mixed with each other in variable proportions, and with vegetable matter; besides which, carbonate and sulphate of soda are sometimes mixed with it in such quantities as to render the land almost worthless. The climate is hot and dry, and little rain falls, except in the higher country, and under the influence of the south-west monsoon. The winters are cool even to a European, the temperature varying from 34° to 75° Fahr., seldom higher; whereas in summer the heat is excessive, and more oppressive even than in the most sultry parts of Arabia.

Vegetable Productions.—The indigenous vegetation of the Panjab bears a close resemblance to that in the plain of the Ganges; but as its natural resources have been but little improved, the cultivated products of the two countries admit of no comparison. According to Burnes 'the soil amply repays the labour; for such is its strength that a crop of wheat, before yielding its grain, is twice mowed down as fodder for cattle, and then ears, producing an abundant harvest.' The principal grain crops are wheat and barley, of excellent quality, buckwheat and millet, pease, vetches, and mustard; sesamum, and other oil seeds are extensively grown. Turnips, carrots, onions, cucumbers, and melons are raised in large quantities. The crops of indigo and sugar are very rich, and both articles are plentifully exported. The tobacco plant also grows luxuriantly, especially about Multan, and opium has been grown pretty extensively. Among the fruits are the date, orange, fig, vine, apple, mulberry, banana, and mango; but these occur only in a cultivated state, and near the towns. Large trees are scarce, and extensive tracts may be passed without meeting anything larger than mimosas, acacias, camel-thorns, and other bushes; for which reason wood-fuel is very scarce, being commonly replaced by cow-dung.

Animals.—The zoology of the Panjab is richer and more varied than its botany. Tigers of enormous size abound in the jungles, nor are lions by any means uncommon; besides which there are great numbers of panthers and leopards, wild cats, hyenas, lynxes, jackals, and wolves, with foxes, martins, stoats, &c. The plains also are covered with herds of wild horses, nylghaus, and buffaloes; deer, antelopes, and goats, both black and white, abound in the wilder regions; apes of various kinds are common, as well as bats, including the large and hideous vampire. Elephants are sometimes used as beasts of burden, but mules and asses are in far more common use. Among the birds are found eagles and vultures, hawks, magpies, many varieties of parrots, pea-fowl, and jungle-fowls, partridges and quails, water-fowl of many kinds, herons, cranes, and pelicans, with doves, pigeons, and many of the smaller birds, including the *bulbul* or eastern nightingale. The rivers abound with alligators; venomous serpents are com-

mon, especially the cobra-de-capello. The silkworm thrives remarkably well, and bees are plentiful, producing great quantities of fine honey.

People, Dress, &c.—The population of the Panjab is composed of various races, the chief of which are the Jats, Cathis, Rajputs, and Patans. The prevailing religions are Mohammedanism and Hinduism, the latter of which counts among its adherents the heterodox sect of the Sikhs. The Jats form the bulk of the agricultural peasantry; the Cathis are a pastoral people, addicted to a roaming life, and are described as tall and athletic, with handsome, open countenances, blue eyes, and light hair. The people indeed, generally, are in physical respects superior to those of Hindustan, and to the full as active as the Mahrattas, having stout, well-rounded limbs, and an active, graceful carriage, particularly the better classes. The women too are elegantly shaped and very attractive; their costume embraces trousers and extraordinarily high conical caps. The male attire consists of a *pagri* or sort of turban, a close-fitting jacket, and large bulky trousers usually terminating at the knee, with a scarf thrown over the shoulder, either with a coloured trimmed border or consisting of a gaudy-coloured shawl; the rest of the dress is invariably white, and kept for the most part very clean. The hair is worn long, and gathered up into a knot at the crown. The Sikhs are almost exclusively a military and agricultural people,—barbarous indeed from want of knowledge, but neither savage nor cruel, being, on the other hand, frank, generous, and lively. The Sikh soldier is, generally speaking, brave sometimes even to desperation, active, cheerful, and merry—without polish, but destitute neither of sincerity nor attachment. The Sikh merchant or farmer, if he be a *Sinh*, differs little in character from the soldier, except that he is less presuming and boisterous. He also wears arms, and can use them promptly and with effect when required; and as regards character, he is as intriguing, versatile, insinuating, and artful as any of the lower classes of Hindus.

The *Religion* of the Sikhs is a heterodox form of the Hindu faith. The notion of a supreme deity, who is both creator and protector, pervades the poetry of Nanal and his fellow bards, who are looked upon as the exponents of the national creed; and hymns are chanted at daily services to that deity who is designated by various popular names of the Hindu god Vishnu. The existence of other Hindu deities is not disputed, but no divine honours are publicly paid to any of them. An important distinction between the Sikhs and the other Hindus is the absence of caste, and consequently of most of the restraints inherent in that institution. The Sikhs do not refuse to eat or to intermarry with other Hindus who have become converts to their form of religion, but they do not extend the same liberality to Mohammedans, against whom they have always exhibited great national hostility. The flesh of the cow is the only article of animal food prohibited by their faith, and on this head their prejudices are stronger even than those of Hindus of the orthodox Brahmanical persuasion. Smoking is prohibited, but *bang*, opium, and spirituous liquors are freely used; and it has been said that no race of people in India is more flagrantly demoralized than that of the Panjab. As in the other provinces of India missionary work is carried on here also. In 1872 there were fourteen native ordained ministers, and the number of native Christians amounted to 1870, of whom 707 were communicants.

Language and Education.—The language of the Panjab is a jargon of various tongues; for while a dialect of Hindustani is spoken in the larger towns, the rural population use the Jatski, sprung from a cognate root and the original language of the country, and on the southern frontier there is a considerable admixture of Sindhi. Since the country came under British rule elementary education has received much attention. In the year ending 31st March, 1882, there were 1748 government schools, with 93,856 pupils on the rolls and an average daily attendance of 72,501, besides 341 government aided schools, with 16,571 pupils on the rolls and an average daily attendance of 12,354; making a total of 2089 institutions with 110,427 pupils. The educational institutions include a college with 103 students in 1882. Notwithstanding the progress that education is making, it is still very far behind, especially in the case of girls.

Manufactures and Trade.—The manufacturing industry of the Panjab is far more extensive and important than its agriculture, though it is chiefly confined to the larger towns. Amritsar, Lahor, Multan, and Shujabad are distinguished for their silk and cotton fabrics; and the silks of Multan, called *kais*, and chiefly used for scarfs, possess a strength of texture and brilliancy of colour for which they are much prized in the Indian markets. The shawls of Lahor, too, rank only second to those of Kashmir. Brocades, tissues, and carpets resembling the Persian are also manufactured in the capital. In the east of the Panjab, about Rohun and Hushiarpur, white cotton goods are prepared of a stronger and more durable texture, as well as cheaper, than those of British manufacture. Swords and fire-arms of all sorts, and of an excellent quality, were under the Sikh dynasty made in great quantities at Lahor.

The Panjab enjoys from its position an extensive transit-trade with Cabul, Bokhara, Kandahar, &c., as well as a more direct one for the disposal of its produce and the supply of its internal wants. The imports comprise sugar, spices, and other groceries, dye-stuffs and cotton, woollen and silk fabrics, metals and metallic utensils, cutlery, precious stones, ivory, glass and cochineal, assafœtida, safflower, fresh and dried fruits, wool, horses, &c. The exports—partly of home produce, partly in transit—comprise grain, *ghee*, hides, wool, silk and cotton fabrics, carpets and shawls, raw silk and cotton, indigo, tobacco, gold, hardware, horses, and vast quantities of hawks. The trade of the Panjab is facilitated by upwards of 2400 miles of navigable rivers and 1000 miles of railway.

Government and Revenue.—The government under the Sikhs originally consisted of a sort of republic, or federation of *sirdars* or chiefs, all holding independent sway and administering the laws in their own districts; but these at length, through the rising power of Runjit Singh, became subordinate to the Maharajah, under whom they became feudal chiefs, paying him an allotted portion of the tax or tribute collected within the respective districts. As a usual rule the produce of the land was equally divided between the chief and the farmer, the impost for grain being paid in kind—that for sugar-canes, melons, &c., in cash. The chief, however, never levied to that extent; and in no country, perhaps, was the *ryot*, or cultivator, treated with more indulgence. Commerce, on the other hand, was not a little impeded by the heavy duties levied on goods by the sirdars of the districts through which they passed; and owing to this circumstance, as well as to the long-disturbed state of the Panjab, much of the trade from Hindustan to Cabul and Turkestan was carried by other and longer routes. The government under the British rule resembles that already so long existing in the other districts of the Bengal Presidency, and the revenues are gathered on a similar system. (See INDIA—Revenue and Expenditure.) The most important item of revenue is the land-tax,

which yields upwards of £2,000,000 sterling; next to this comes the tax on salt, which produces upwards of £800,000; the revenue is also partly derived from excise duties on spirits and drugs, duties on stamps, &c. The tax on salt is three rupees per maund, or about 1*d.* per lb. The total revenue amounts to about £4,600,000; the expenditure to about £4,100,000.

Army and Police.—The army of Runjit Singh consisted of 27,000 infantry, of whom 15,000 were clad in armour; 27,000 cavalry, about 700 pieces of artillery, and 100 elephants. The military force established by the Anglo-Indian government comprises about 36,000 British and native troops, with ninety-seven field-guns exclusive of a large frontier force, numbering upwards of 12,000, which is also placed under the orders of the lieutenant-governor. The police force is stated to be in a most effective condition. It numbers about 20,000 men, divided into two divisions, the Trans-Satlej and the Cis-Satlej; 53 per cent. of the men are Mohammedans, 29 per cent. Hindus, and 17 per cent. Sikhs.

History.—The Sikhs appear to occupy the geographical locality of the ancient *Sacæ*. The Panjab was in remote antiquity the scene of some of Alexander the Great's most arduous exploits during his expedition against Porus. About A.D. 920 it was overrun by the troops of Mahmoud of Ghazna, whose successors held the country for nearly 200 years, making Lahor the seat of their government. It afterwards passed by conquest into the hands of Mohammed, sultan of Ghur, after whose death the country was ruled by a succession of turbulent and licentious chiefs, principally Afghans, till at length in 1519 Baber, the founder of the Mogul Empire, having obtained possession of the country, ascended the throne, and established the Timurian dynasty, whose sway prevailed for about two centuries. In 1748 Ahmed Shah Durani overran the Panjab with an Afghan army, and in 1756 the territory was formally ceded to him by the Mogul emperor. At length, in 1768, the Sikhs overran the country east of the Jhilam, establishing military posts in that district. The Duranian dynasty, however, maintained its ascendency in the south-eastern portion till 1809, when, on the expulsion of Shah Shujah, the last of the Afghan kings, Runjit Singh, a Sikh of the tribe of Jats, established his power over the greater part of the Panjab, including the hill-states. In 1818 this renowned chieftain stormed Multan and took Peshawar—in the following year conquering Kashmir and the Derajat west of the Indus; and thus in ten years he succeeded in establishing his power over the whole country of the five rivers, to which were afterwards added, by the conquests of his vassal Gholab Singh, Ladakh or Middle Tibet, and Bultistan or Little Tibet. His right to all the territories he thus possessed on both sides of the Indus was formally acknowledged by the British government in 1838, and in 1839 Runjit Singh died, having amassed, by war and plunder, no less than £10,000,000 sterling of treasure and movable property, and leaving the country in a state of exhaustion and disorder. His son, Khuruk Singh, quietly succeeded, but died of a decline a few months after his father, on which Shere Singh, a natural son of the great Runjit, assumed the sovereignty, but was assassinated 15th September, 1843. Dhulip Singh, a minor, the son of the former maharajah, Khuruk Singh, succeeded without opposition, having Herra Singh, the nephew of Gholab, for his vizier or prime minister; but intrigues and civil disturbances now from time to time distracted the country, and from the close of 1843 to the period of its annexation to British India the government was in abeyance, or, what is worse, in the hands of an ignorant, bloodthirsty, rapacious, and insubordinate army. At length it became manifest that the Sikhs of the Panjab were preparing for an irruption into the territories protected by the British on the east of the Satlej. In the end of December, 1845, the Sikh forces passed the Satlej into the territories protected by the British, with a most formidable train of artillery, but they found themselves completely worsted after the hard-fought actions of Ferozeshah, Aliwal, and Sobraon. Lahor and other stations were afterwards occupied by British troops; the Jallandar Doab, between the Satlej and Bias, was permanently ceded to the British; and the Dominion of Kashmir, and the other provinces of the Himalaya, was vested in the Rajah Gholab Singh. In 1849 a conspiracy between several disaffected chiefs and the Afghans resulted in further hostilities against the British, Multan being the centre of their operations. The indecisive battle of Chillianwalla was followed by the capture of Multan in January, and the victory of Gujerat in February, 1849, since which period the former territories of the Maharajah Dhulip Singh have formed an integral part of the British Empire in the East. In 1849 it was formed into a new lieutenant-governorship.

PUNKAH, an immense fan used in India and other hot countries for ventilating rooms. It consists of a movable frame of wood covered with canvas and suspended from the ceiling. It is pulled backwards and forwards by means of a cord, and thus causes a current of air in the apartment.

PUNO, a town of Peru, capital of the department of the same name, on the west shore of Lake Titicaca, 12,870 feet above sea-level, and 90 miles east by south of Arequipa. It consists of two portions, both of cheerful appearance, and with straight, well-paved streets; and has two churches, a college, and an hospital. The mines to which it owed its origin are now abandoned. Pop. 6000.—The department grows potatoes and barley, but is particularly distinguished by the extent and richness of its pastures. Its principal exports are the wool of the sheep, llama, alpaca, and vicuña, and some cascarilla bark from the valley of Carabaya. Pop. 256,594.

PUNT, an Anglo-Saxon term still in use for an oblong flat-bottomed boat used for fishing and shooting in shallow waters; it is also used in caulking and repairing ships. The most common mode of propulsion is by pushing with a pole against the bottom of the river, &c., a process which is hence called punting.

PUPA, the name applied to the second stage in the metamorphosis of insects. This stage has also been named the *nymph* (which see) or *chrysalis* period of development. In the typical Complete or Holometabolic Insects, exemplified by Beetles, Butterflies, Flies, &c., the pupa stage is marked by quiescence and rest, and thus presents a contrast to the preceding and active larval stage. The pupa may be inclosed within a case or *cocoon*, as in Butterflies and Moths, or may simply remain quiescent within the hardened larval skin, which thus serves as a pupa-case. During the pupa stage the elements of the larval form are being remodelled into that of the *imago* or perfect insect, which in due time emerges from the pupa case. The time in which an insect may remain in the pupa stage varies very greatly throughout the different groups of insects, and may extend from a few hours or days to weeks, months, or even years.

The pupæ of the Hemimetabolic Insects, or those which undergo an incomplete metamorphosis (such as Grasshoppers, Locusts, Bugs, &c.), are active and freely moving, and differ from the perfect insect, which they resemble in form, chiefly in the absence or rudimentary nature of the wings. These latter

structures in the pupa state of Hemimetabolic insects may generally be perceived to be in course of formation, the perfect insect or imago state being characterized simply by the full development of the wings. See also ENTOMOLOGY, INSECTA, NYMPH, METAMORPHOSIS.

PUPIL. See EYE.

PUPPET-SHOWS. One of the most common classes of puppets are called, in French, *marionnettes* (from *morio*, fool, buffoon, as Frisch supposes). These are images of the human figure moved by wires or threads on a stage, and made to perform little dramas, the dialogue of which is carried on by the person in concealment, who moves the figures. In the common street performance of Punch and Judy, however, the performer puts his fingers in the figures. Puppet-shows were common among the Greeks (who called them *neurospasta*), from whom the Romans received them. Xenophon, Aristotle, Gellius, Horace, and others mention them. Such exhibitions, which are so pleasing to children and the uneducated, naturally passed through various degrees of perfection in different ages, and even now exhibitions of puppets are common in some countries which display great mechanical ingenuity, while the poor hand-organ boy in the street still turns his instrument, and gives to one or two figures on a board before him a few simple motions with his foot. Clocks for the peasants often display movable puppets, and it is not unfrequent in Germany to find on ancient town clocks puppets which move whenever the clock strikes. In 1674 there was a puppet opera at Paris, which met with great applause. At present there are two theatres in Paris for puppet-shows, and they still continue to be performed in several large cities of Italy. In Germany, also, excellent puppet-shows are sometimes seen, but they are there hardly ever stationary, and are not by any means so much patronized as in Italy.

PURANAS. See SANSKRIT LANGUAGE AND LITERATURE.

PURBECK, ISLE OF, a district in England, forming the south-east angle of Dorsetshire, and consisting of a peninsula surrounded by the sea on the south and east, and so separated from the mainland on the north by Poole harbour and the Frome, and on the north-west by a rivulet called Luckford Lake, as to be connected with it by only a very narrow isthmus. It is about 12 miles long by 7 miles broad; is traversed from west to east by a chalky ridge dividing it into two parts—a northern, covered chiefly with heath, and a southern, which is generally fertile. The prevailing rock is limestone, one kind of which, being susceptible of a good polish, though deficient in durability under exposure to the air, takes the name of Purbeck marble.

PURBECK BEDS. See GEOLOGY.

PURCELL, HENRY, an eminent English musical composer, was the son of a musician of the chapel-royal, who, dying in 1664, left him an orphan in his sixth year. He was admitted at an early age a chorister in the king's chapel, where he studied music under choir-master Cook and his successor Pelham Humphrey, and afterwards under Dr. Blow. In 1676, when only eighteen years old, he was made organist of Westminster Abbey, and six years afterwards was appointed to fill the same office at the chapel-royal, St. James'. From this period his fame seems to have increased rapidly, his anthems and church music in general being popular in all the cathedrals of the kingdom; nor were his compositions for the stage and music-rooms less successful. His genius embraced every species of composition with equal facility; and with respect to chamber music, all prior productions seem to have been at once totally superseded. Of his numerous compositions his celebrated Te Deum and Jubilate appear to have been composed for the celebration of St. Cecilia's Day, 1694. Of his instrumental music a collection was published two years after his decease, containing airs in four parts, for two violins, tenor and bass. Many of his songs were published after his death under the title of Orpheus Britannicus. Ye Twice Ten Hundred Deities, contained in this collection, is considered the finest piece of recitative in the language; while his music in King Arthur has maintained its popularity undiminished till our own day. In 1695, the year of his death, he set to music Bonduca, and the Prophetess, an opera altered by Dryden from Beaumont and Fletcher; and he was the author of a vast variety of catches, rounds, glees, &c., not less remarkable for their melody than for their spirit, humour, and originality. All his works have been collected by Vincent Novello, who issued a complete edition of them in sixty-two parts, under the title of Purcell's Sacred Music (London, 1826–36). Purcell died in 1695, and was buried in Westminster Abbey. The epitaph on his tombstone is ascribed to Dryden.

PURCHAS, SAMUEL, an English divine, was born in 1577, at Thaxted, in Essex, and educated at Cambridge. In 1613 he published an important work entitled Purchas his Pilgrimage, or Relations of the World and the Religions observed in all Ages and Places. The fourth edition of this work, published in 1626, contains numerous important additions, and is generally sold as the fifth volume of his second great work, namely Hakluyt's Posthumus, or Purchas his Pilgrimes, published in four vols. folio, in 1625. These works, with Hakluyt's Voyages, led the way to other collections of the same kind, and have been much valued and esteemed. The difference between the two books is that the first is a compilation in Purchas's own language, whereas the second is a collection of narratives written by various authors, supplemented and edited by Purchas. The whole five volumes are generally known as Purchas's Pilgrims. He also wrote Microcosmos, or the History of Man, a Series of Meditations on Man at all Ages and in all Stations (8vo), the King's Tower and Triumphal Arch of London, a sermon. Purchas was rector of St. Martin's in Ludgate, and chaplain to Abbot, archbishop of Canterbury, and was highly esteemed for his learning and piety. He died in London in 1628.

PURCHASE, in law, the acquiring of land with money, by deed or agreement, and not by descent or right of inheritance. *Purchase* is also a name given to any sort of mechanical power employed in raising or removing heavy bodies.

PURCHASE IN THE ARMY, a system, now abolished, by which more than half the first appointments and subsequent promotion of officers used to be effected. The prices of commissions were fixed as follows:—£450 for a cornetcy or ensigncy; £700 for a lieutenancy; £1800 for a captaincy; £3200 for a majority; and £4500 for a lieutenant-colonelcy, which was the highest rank that could be obtained by purchase. An officer wishing to retire from the service might sell his commission for the price affixed to the rank he occupied. When a superior officer 'sold out' the next officer inferior to him might purchase promotion to the rank of the former by merely paying the difference between the prices of their respective commissions. The rank of the second might be reached in the same manner by his next inferior, and so on down to the ensign. No commission could be purchased by one officer unless another officer vacated his commission by its sale. The regulation prices were not, however, always adhered to, nor the method here specified followed; and in this way complications arose which frequently occasioned no small difficulties in the carrying out of the system.

The system of purchase dates from the first formation of a standing army. An act was passed in 1552, under the reign of Edward VI., prohibiting the sale of commissions; in 1683 a royal warrant ordained the payment of 1*s.* in the pound on the surrender of a commission, but a few years subsequently all payments were interdicted. The purchase of commissions was legalized in 1702, various restrictions being afterwards imposed. The practice of selling commissions above regulation prices having become very prevalent, two commissions of inquiry—one in 1725 and another in 1765—were appointed to report on the matter, and in 1809 over-regulation prices were made penal. From 1840 to 1870 no fewer than eight royal commissions were appointed in connection with the purchase system, and on July 20th, 1871, this system was abolished by royal warrant. By the Regulation of the Forces Act, passed in the latter year, it is provided that every officer holding a saleable commission in the army on Nov. 1, 1871, shall be entitled to compensation in respect of such commission. It has been calculated that about £8,000,000 will be required to satisfy all claims for compensation under this act. By an act passed in 1875 an officer is permitted to receive money for exchanging his commission with another of equal rank.

PURGATIVES are medicines used for the purpose of producing the evacuation of the bowels. These medicines may act in three different ways on the alimentary canal: first, by stimulating the muscular fibres of the intestines, whence their peristaltic motion is augmented, and the contents of the bowels quickly and completely discharged. This kind of action is of the greatest importance in many forms of fever, and may be produced by preparations of jalap, senna, &c., in combination with calomel, and such auxiliaries as manna and other mild laxatives Secondly, they may act by stimulating the exhalent vessels so as to produce an increased discharge of serous fluids. Saline purgatives, such as the seidlitz and sodaic powders, the acetate of potash, sulphate of magnesia, and many vegetable purgatives, of which elaterium is the most powerful, come under this head; and they are extremely useful in inflammatory fever, dropsy, and other diseases of this kind. The third kind of action is the augmentation of the biliary and pancreatic secretions. This is effectually done by mercurials combined with drastic, and even tonic and mild purgatives, in moderate doses, such as the combination of small doses of calomel or the mercurial pill with the extract of colocynth, or the compound rhubarb pill, &c. In all chronic diseases purgatives may be used with considerable success, but they must be continued in many cases for a long period, and require the greatest attention not only to the nature of the purgative employed, but to its effect on the stools or alvine secretions. In cases of persons not invalids suffering from constipation, the best cure is likely to be found in a change of diet; for example, a greater quantity of such vegetables as boiled carrots, turnips, parsnips, &c., also apples and various other kinds of fruit, may produce the desired alteration. If, however, purgative medicines are occasionally used by those in ordinary health, senna, Epsom salts, castor-oil, or some other simple purgative, will answer better than any quack medicine.

A common classification of purgatives is the following:—(1.) *Laxatives* or *Mild Cathartics*, such as manna, cassia pulp, tamarinds, prunes, honey, phosphate of soda; castor, almond, and olive oils; ripe fruit. (2.) *Saline or Cooling Laxatives*, such as Epsom salt, Glauber's salt, phosphate of soda, Seidlitz powders, &c. (3.) *Active Cathartics*, occasionally *acrid*, frequently *tonic* and *stomachic*, such as rhubarb, senna, and aloes. (4.) *Drastic* or *Violent Cathartics*, such as jalap, scammony, gamboge, croton-oil, colocynth, and elaterium. (5.) *Mercurial Purgatives*, such as calomel, blue pill, quicksilver with chalk, &c.

PURGATORY, according to the dogma of the Roman Catholic Church, is the intermediate state between death and final doom, in which the souls of the righteous expiate, through temporary suffering, the sins committed in this life, and are rendered sufficiently pure to enjoy the happiness of heaven. It does not appear to have been made an article of faith until the tenth century, when, according to Mosheim, 'the clergy, finding these superstitious terrors admirably adapted to increase their authority and promote their interest, used every method to augment them; and by the most pathetic discourses, accompanied with monstrous fables and fictitious miracles, they laboured to establish the doctrine of purgatory, and also to make it appear that they had a mighty influence in that formidable region.' The Council of Trent decreed it as an article of faith that 'there is a purgatory or place of torment after this life, for the expiation of the sins of good men which are not sufficiently purged here; and that the souls there detained are helped by the masses, prayers, alms, and other good works of the living.' This doctrine the Catholics hold to be confirmed both by the testimony of Scripture and by apostolic tradition. The so-called testimony of Scripture is the vaguest and most meagre that could possibly be taken to found a doctrine upon. A single passage from the apocryphal book of Maccabees (2 Macc. xii. 38) is all they can cite to prove that it was held by the Jews, and this only refers to prayers for the dead. In the New Testament the Gospels furnish only one text (Matt. xii. 32), than which nothing can be more vague as supporting such a view; the epistles furnish two, 1 Cor. iii. 15 and 1 Peter iii. 19; but it is difficult to see by what canon of interpretation they can be made to prove the doctrine of purgatory. With regard to apostolic tradition not even here can support for the doctrine be found; it was unknown to the Christian Church during the first six centuries. The conceptions of the fathers regarding a purgatorial fire were so varied and contradictory that they never took shape in a dogma. Augustine has implicitly denied the existence of purgatory. 'Let no one,' he says, 'deceive himself; there are only two places (for souls); no third place exists.' He expresses himself in similar terms in other parts of his works. Augustine nevertheless was the first who advanced as an hypothesis the possibility of the existence of a purgatorial fire in the interval between death and the resurrection. Such, however, was the estimation in which all the sayings of this great man were held that what he had merely conjectured was soon looked upon as an indisputable truth. Gregory the Great gave it a further extension; and later on it was, as we have seen, made an article of faith binding on the whole church. Since that time the Catholic doctrine has been that the souls of the faithful whom God judges pure enter immediately into paradise; those who have not received grace, together with those who are defiled by mortal sins, go to hell; while those who, though in a state of grace, are yet charged with certain impurities, or sins not sufficiently expiated in this life, must be purified by a sojourn in purgatory prior to their entrance into heaven. Souls only suffer in proportion to the greatness of their offences, both in respect to intensity and duration. Their sufferings, however, can be mitigated and the souls may even be liberated by masses and prayers offered in their behalf by the living. The pope has also the power of granting indulgences to the faithful, which have the effect of shortening the duration of the sufferings of a soul in purgatory. The abuses to which this dogma gave rise in respect

to the sale of indulgences was, it is well known, one of the immediate causes which precipitated the Reformation in Germany. The doctrine was rejected by all the reformers of the sixteenth century, and earlier by the Waldenses and other sects. The Greek Church has never held this doctrine, though it admits the cognate one of prayer for the dead. Neander conceives that the source of the doctrine of purgatory is to be sought for in the ancient Persian doctrine of a purifying conflagration which was to precede the victory of Ormuz, and consume everything that was impure. From the Persians it passed with modifications to the Jews, and from them found its way into the ethical speculations of the Christians.

Besides the inconclusiveness of the texts of Scripture cited in support of a purgatory, and the inapplicability to the doctrine of the so-called testimony of the fathers, which for the most part refers only to prayer for the dead and the doctrine of Limbus, it may be argued that Scripture in general speaks of departed souls going, immediately at death, to a fixed state of happiness or misery, and gives us no idea of purgatory. (See Isa. lvii. 2; Rev. xiv. 13; Luke xvi. 22; 2 Cor. v. 8.) Moreover if Christ died for us and redeemed us from sin and all its consequences, then the idea of further meritorious suffering implied in this doctrine detracts from the perfection of Christ's work. It seems very strange also, if such sufferings await those who are to be finally saved, and if it is possible through the instrumentality of the living to mitigate these sufferings, that no mention of either the evil or its remedy is made in any part of the New Testament.

PURIFICATION, a Jewish rite, through the performance of which an Israelite, ceremonially unclean, was readmitted to the privileges of religious communion, lost through uncleanness. The ground element in purifications was water; but various and sometimes very elaborate ceremonies were observed according to the nature of the uncleanness from which the person was to be purified. The taint of uncleanness was removed in some cases by simple ablution of the person (Lev. xv. 18), in others by ablution of the clothes (Lev. xi. 25–40). Higher degrees of uncleanness required among other things a probationary interval of greater or less extent and offerings of atonement, as in the case of men having issues (Lev. xv. 1–15), in the 'custom of women.' (Lev. xv. 19–30), and in the uncleanness of childbirth (Lev. xii.) The highest degree of uncleanness was connected with death, death being the penalty of sin. The method of purifying persons who had contracted uncleanness through contact with a dead body is detailed in Numbers xix. In regard to leprosy, this disease being regarded by the Hebrews as a living death, and as consequently occasioning the worst type of uncleanness, the process of purification was the most elaborate of all, and is fully described Lev. xiv. 4–32. The ceremonies to be observed in the purification of a house or a garment infected with leprosy were identical with the first stage of the proceedings used for the leper (Lev. xiv. 33–53). The necessity of purification was extended after the captivity to a variety of unauthorized cases, such as the washing of cups and pots, &c., referred to in Mark vii. 4. Different from that noticed above was the purification performed in the consecration of priests, and that to be undergone by proselytes at baptism. Besides these ablution was necessary prior to the performance of special religious acts. Purification was not peculiar to the Jewish nation; it was observed amongst the Greeks, Persians, and other nations. The Jewish rite, however, possessed this distinctive feature, that it was of an expiatory nature. 'The Jew alone was taught by the use of expiatory offerings to discern to its full extent the connection between the outward sign and the inward fount of impurity.'

PURIFICATION OF THE BLESSED VIRGIN MARY, Feast of the, called also 'the feast of the presentation of the child Jesus.' A festival held on the 2d of February in commemoration of the day on which Mary entered the temple, 'when the days of her purification, according to the law of Moses, were accomplished,' there to present the infant Jesus to the Lord, and offer the sacrifice of a pair of turtle doves required by the law (Luke xxii. 24). The institution of the festival dates from a very remote period of the Christian Church. It was introduced into the Roman Church in 494 by Pope Gelasius, and it was sought to substitute it for the pagan festival of the Lupercalia, celebrated in honour of Pan, the god of shepherds. In the celebration of the Catholic festival it is the practice for each of the processionists to carry a lighted taper, which signifies, according to the interpretation of the mystics, the light which Jesus came to bring into the world.

PURITANS, in the English Church, a sect who professed to follow the pure Word of God, in opposition to traditions, human constitutions, and other authorities. The Reformation in England was brought about in a manner quite different from that in which it took place in other countries. A purely personal affair of Henry VIII. was the immediate occasion of the change which from a Catholic country converted England into a Protestant one. Occurring at a time when the nation was scarcely ripe for the change, and under the peculiar circumstances under which it did occur, the Reformation was not so complete as it might otherwise have been. The consequence of this was that the more advanced reformers were dissatisfied with what they considered the imperfectness of the change, and with the retention in the reformed Church of England of much that savoured of Catholicism. This party continued to grow in numbers and in importance, and in the reign of Queen Elizabeth the Protestants were divided into two parties, those who were in favour of adhering to the liturgy established in the reign of Edward, and those who wished to introduce a simpler, and, as they considered it, a purer form of church government and worship. The latter were termed *Puritans*, and many of the distinguished clergy favoured these views. The queen, however, and a majority of the clergy preferred the Episcopal form of government, and were attached to many forms and ceremonies upon which the Puritans looked with aversion. The rigorous measures followed by the dominant party to compel conformity only served to alienate the Puritanical party, and to push them into more decided opposition to the ceremonials of divine worship. In 1566 the Puritans resolved that duty required them to break off from the church, and assemble as they best could by themselves, to worship God in their own way; they also laid aside the English liturgy, and adopted the Geneva service-book. They objected further to the hierarchy, as not authorized by Scripture, to kneeling at the sacraments, using the sign of the cross in baptism, bowing at the name of Jesus, wearing the surplice and other vestments in divine service, &c. In point of doctrine there was as yet no difference between the Puritans and Conformists; the former, however, as was natural for a persecuted party, maintained that every man had a natural right to judge for himself, without being subject to the laws of the civil magistrate, or the decrees of councils, churches, or synods. Towards the end of Elizabeth's reign a party arose which were first for softening, and then for overthrowing, the received opinions concerning

predestination, perseverance, free-will, effectual grace, and the extent of Christ's redemption. The clergy of the church began to lean towards Arminianism, while the Puritans adhered rigorously to the system of Calvin, and all Calvinists, whether Episcopal or Presbyterian, were called *doctrinal Puritans*. The name was applied to all who were remarkably strict in their morals, and severe in manners. Elizabeth treated the Puritans with great rigour during the whole of her reign; besides the ordinary courts of the bishops, she erected the court of high commission, which suspended and deprived the refractory of their livings, by the determination of three commissioners, founded upon the canon law; before this court the prisoner was obliged to answer questions put to him under oath; if he refused to swear he was imprisoned for contempt, and if he took the oath he was convicted upon his own confession. During the reign of James I., from whom the Puritans had expected more indulgence, they were treated with greater severity, and many of them left the kingdom and retired to Holland, whence they emigrated to America in 1620. All who opposed the arbitrary maxims of his government were looked upon by James and the court as *Puritans*, and these were called *Puritans* in state, who, uniting with the *church* Puritans in opposition to the tyrannical principles of the Stuart dynasty, formed a majority in the nation. The success of the first emigrators to America, who established the colony of New Plymouth, induced great numbers of Puritans to turn to the same quarter for relief, and the new colony of Massachusetts Bay was founded by them in 1629. The colony of New Haven was also founded by Puritans who fled from the persecutions of Laud, and the oppressions of the Star Chamber and the high commission courts. Though there were shades of difference in these fugitives to America, they agreed in most points of doctrine and discipline, and most of their descendants in New England, of which they compose a principal part of the population, still cherish with fondness the maxims and the memory of their Puritan fathers. The Puritans were afterwards prevented from retiring to America, and many of them removed into Holland, while others remained at home and finally pulled down the throne and the altar, which long persecutions had rendered so odious to them. (See CROMWELL, HAMPDEN, PYM, &c.) It was the union of the three kinds of Puritans above-mentioned which gave the Parliament the victory in the civil war which followed. The Presbyterian party was at first the most powerful, but the Independents, among whom were Cromwell, Milton, &c., finally acquired the ascendency; and it was this party, most of whom were republicans in politics as well as in church discipline, that beheaded the king and abolished royalty. After the restoration of Charles II., the act of uniformity (1662) excluded from the communion of the church all who refused to observe the rites and subscribe the doctrines of the Church of England; and from that time the name of *nonconformists* was applied to such recusants as, for instance, Presbyterians, Independents, Quakers, &c. See NONCONFORMISTS, and ENGLAND—Church. For a complete history of the Puritans the reader may consult Neal's History of the Puritans (four vols. 8vo, 1732–38, often reprinted).

PURNIAH, a town of Hindustan, in Bengal, province of Behar, capital of the district of the same name, 230 miles north by west of Calcutta, consists of the town proper and a series of straggling suburbs. The town incloses a space of about 3 miles square, much of it, however, occupied by plantations, gardens, and open places. The best part, situated on the left bank of the Little Kusi, consists of three parallel streets, one of them about half a mile long, wide, tolerably straight, and lined with houses which are generally well built and tied. Among the inhabitants are a number of wealthy capitalists engaged in banking. Pop. 16,057.

PURPLE. The colour to which the ancients applied the name *purple* was either dark, or violet and rose-coloured, and was one of the most costly dyes with which they were acquainted. They obtained their purple dyes partly from plants, and partly from several kinds of shell-fish, as the *buccinum*, and the *murex* or *purpura*. In modern times a similar purple matter has been found in several other shell-fish. It is a viscous juice contained in a little pouch or bag, lying generally between the heart and liver. The colour of the juice varies, being in some purplish red, in others pale yellow or orange coloured. Réaumur found that the juice taken from one of these shell-fish, on being applied to linen, changed in the course of a few seconds from yellow to green, blue, and finally to purplish red. The juice of the *sea-snail*, found by the Spaniards in Peru, and used for dyeing, presents similar phenomena. Cochineal is much used for purple dyes by the moderns. The ancients attributed the discovery of purple to the Phœnicians. The story of its having been discovered by a dog biting a purple-fish, and thus staining his mouth, is well known. The purple fish was found not only on the Phœnician coasts, but in all other parts of the Mediterranean, so that the use of it in dyeing came to be common with other nations; but the Phœnicians excelled in the beauty and permanence of their colouring. The Tyrians excelled particularly in the bright red and violet shade. They dyed the finest wools of this colour, usually twice, and then gave an artificial brilliancy to the stuff. But as the colouring fluid could only be had in very small quantities from the shell-fish, purple-dyed garments were reckoned of almost priceless value (comp. Jer. x. 9; Ezek. xxiii. 6; Dan. v. 7). The recent discovery of purple colours from coal-tar makes an important epoch in the history of the dye.

PURPLE GRACKLE. See CROW-BLACKBIRD.

PURPLE OF CASSIUS, a purple substance used to some extent in the arts, discovered by Dr. Cassius at Leyden in 1683. This substance is probably an oxide of gold containing small quantities of oxide of tin; it is prepared by adding protochloride of tin, along with a little perchloride, to a solution of chloride of gold, when it is thrown down in the form of a dark purple-coloured precipitate. Purple of Cassius, mixed with borax and applied to the surface of china, imparts a beautiful rose-pink or rich purple colour, according to the quantity employed. It is also used for colouring red Bohemian glass.

PURPLES, THE, or PURPURA, a disease in which the surface of the body is covered with specks or patches of a dark purple or livid colour, the eruption being accompanied with great debility, and frequently a degree of fever. The specks or patches are the result of extravasation from the minute vessels beneath the cuticle, and resemble the petechiæ seen in bad typhus fever, or the spots in cases of sea-scurvy. The worst form of this disease is the *purpura hæmorrhagica*, or bleeding purpura, in which the blood is often effused in large quantities from the surface, giving rise to great prostration of strength, and generally terminating fatally. This disease is limited to no age or sex, but women, and also boys before the age of puberty, are more liable to it than others, especially those of delicate constitutions who live in cold damp houses. The *treatment* depends essentially on the habit of body and the age and strength of the patient. Moderate blood-letting is recommended in most cases at the commencement; but the disease

may be removed without it, and care should be taken not to resort to it if there is evidence of anæmia or of deficient crasis of the blood. In later stages of the disease gentle laxatives should be administered, also small doses of the mineral acids frequently repeated, combined with decoction of Peruvian bark; and when typhoid symptoms appear the constitution should be supported by means of wine and other stimulants. For diet during the progress of the malady milk, in conjunction with rice and farinaceous articles, should be allowed, also fresh vegetables and fruits. Animal food should be used very sparingly.

PURPLES, Ear Cockle, or Peppercorn, a disease affecting the ears of wheat, produced by a minute free or non-parasitic Nematoid worm (see Nematelmia), allied to the well-known Vinegar Eels, and termed the *Tylenchus* or *Vibrio tritici*, or 'Wheat Eel.' This disease was first described during the last century by Needham. The infected grains of wheat appear at first to assume a dark-green colour, which soon deepens to a black. The grains alter in shape, and become rounded and furrowed on their external surface. The husks open, and the diseased grains are found to contain no nutriment or flour, but to be filled with a moist substance of white colour and of cottony consistence. If this substance be submitted to microscopic examination the characteristic Nematoid worms above alluded to may be seen. These forms appear to enter the grain in March, and to ascend into the young plant and reach the seeds or ovules. They then deposit their ova and die, the young being developed in about eight or ten days. In their early state the young vibrios may measure $\frac{1}{30}$d of an inch in length and about $\frac{1}{1200}$th of an inch in diameter. When fully grown they may attain a length of $\frac{1}{4}$ inch and $\frac{1}{30}$th of an inch in diameter. A single grain of wheat may contain 50,000 young vibrios. The vitality of these forms seems to resemble that of the Rotifera or 'Wheel Animalcules,' in that they may be desiccated or dried, and restored again on the application of moisture many times in succession, and, according to Bauer and Henslow, throughout a period of six or seven years. No absolute remedy for this disease is known, but scalding or boiling water has been ascertained to kill these Nematoids.

PURSE, among the Turks, the sum of 500 piastres, or £4, 10*s.* sterling. In Persia the purse is 50 tomans, or £23, 4*s.* 7*d.*, the toman being worth 9*s.* 3½*d.* sterling.

PURSER, in the navy, an officer appointed by the lords of the admiralty to take charge of the provisions and slops of a ship of war, and to see that they were carefully distributed to the officers and crew according to the printed naval instruction. He had very little to do with money matters beyond paying for short allowance. He was allowed one-eighth for waste on all provisions embarked, and additional on all provisions saved; for which he paid the crew. The designation is now discarded for that of *paymaster*.

PURSLANE (*Portulaca oleracea*, natural order Portulacaceæ), a plant said to have come originally from India, but now almost universally diffused through the civilized world. The stems divide from the base into several prostrate branches, which are clothed with sessile, smooth, and wedge-shaped leaves; the flowers are small, yellow, and axillary. The whole plant is succulent. Formerly it was cultivated as a pot-herb for salads, garnishings, and pickling, and it is still sometimes employed for those purposes.

PURSUIVANT. See Poursuivant.

PUSEYISM. See Tractarianism.

PUSHKIN, Alexander, Count of Sergejevitch, an eminent Russian poet, was born at St. Petersburg in 1799, and received his first education in the Lyceum at Zarskoje-Selo. He very early began writing verses, and in his fourteenth year published a poem entitled Recollections of Zarskoje-Selo. The very favourable reception given to it so overjoyed him that he abandoned all other studies and lived for poetry alone. Afterwards, however, on returning to St. Petersburg, he took the wiser course of giving much of his time to the study of history and the ancient classics. With the spirit of youth, and inspired by the free spirit of the ancients, he wrote an Ode on Freedom, which led to his banishment from the capital in 1820. On the accession of the Emperor Nicholas in 1825 he was restored to favour, and the appointment of imperial historiographer was conferred upon him. His best works are Russia and Ljudmilla, an epic in six cantos; the Mountain Prisoner, a fresh and vigorous picture of the predatory habits of the Caucasian mountaineers; and, above all, the Fountain of Baktshissarai. Mention may also be made of his portraiture of a young libertine, under the name of Eugene Onegin. His dramatic poem, Boris Godunov, is an excellent and lively picture of the manners of that period. One of his greatest defects is a manifest and often slavish imitation of Byron. He died in 1837, his death being occasioned by a wound he received in a duel.

PUTEAUX (Latin, *Puteoli*), a town of France, in the department of the Seine, on the left bank of the Seine, 6 miles west of Paris. It has manufactures of printed calicoes, dye-works, worsted and silk mills, and plaster-kilns. Almost all the ground in the neighbourhood is laid out in kitchen-gardens, or employed in raising roses, the leaves of which are sold to the Parisian perfumers. Pop. (1881), 15,586.

PUTEOLI, the ancient name for Pozzuoli. See Pozzuoli.

PUTNEY, a village and parish of England, in the county of Surrey, on the right bank of the Thames, opposite Fulham, with which it is connected by a bridge. Among its buildings are three churches, one of them with a restored ancient tower; several dissenting chapels, and endowed schools for the sons of watermen. Putney is perhaps best known as the head-quarters of the rowing world. Gibbon the historian was born here. Pop. (1881), 13,235.

PUTREFACTION is a phenomenon due, as M. Pasteur has lately demonstrated, to the presence of animalcules, which cause a similar alteration in putrescible matter to that produced by us in the air which we breathe. These animalcules are developed in the midst of the matter, decomposing and disorganizing it, and generating in the process a great number of gases and liquid products of a more or less putrid odour. Before putrefaction sets in organic matters first undergo an isomeric modification of their immediate active principles remarkable for its virulence. It is in this state that dead bodies are formidable, and that pricks received whilst dissecting them are mortal. Putrefaction takes a certain time to declare itself, according to the circumstances of temperature, &c. In the most favourable circumstances it will take at least twenty-four hours before the phenomenon begins to show itself by external signs. Putrefaction is prevented by the exclusion of all air, or by the action of intense cold, which states are opposed to the development of the animalcules. The gases generated in process of putrefaction are carbonic acid, nitrogen, carburetted and sulphuretted hydrogen, vapour of water, ammonia and ammoniacal compounds, &c. These putrefactive effluvia are for the most part easily decomposed, and resolved into new and comparatively innocuous compounds, by means of chlorine; hence the importance of that body as a powerful and rapidly acting disinfectant. The most effective anti-putrefactives or antiseptics are certain

kinds of salt, sugar, alcohol, carbolic acid, kreasote, and generally whatever either absorbs or removes some of the moisture and enters into new combinations with the organic matter. See DECOMPOSITION and FERMENTATION.

PUTTY, a kind of paste, compounded of whiting and linseed-oil, beaten together to the consistence of a thick dough. It is used by glaziers for the purpose of fixing sheets of glass in the frames of windows, &c., and also by painters for filling up holes in the surface they are about to paint. As it becomes very hard when it dries it is sometimes found advantageous where some degree of elasticity is required, as in large panes liable to contract and expand through changes of temperature, to mix the putty with fine Russian tallow in the proportion of 1 part of the latter to 12 of the former.

PUTTY-POWDER, a substance consisting of the peroxide of tin. When tin is melted in an open vessel its surface soon becomes covered with a gray powder, which is an oxide of the metal. If the heat is continued the colour of the powder gradually changes, and at last becomes yellow. This scum is then taken off, and after being allowed to cool is reduced to a very fine powder. In this state it is much employed in polishing glass and other hard substances. It is also used as a colouring matter for white glass, the white enamels of porcelain, &c.

PUY, or PUY-EN-VELAY, LE, a town of France, the capital of the department of Haute-Loire, 270 miles S.S.E. of Paris, picturesquely situated on the south slope of Mount Anis, on which it rises in the form of an amphitheatre between the Borne and the Dolaizon. Overtopping the houses is a vertical rock of volcanic breccia crowned with a colossal bronze statue of the Virgin made from cannon taken at Sebastopol, and on a conical rock of basaltic tufa, rising abruptly from the Borne to the height of 265 feet, is an ancient Romanesque chapel, approached by a stair partly cut in the rock. The interior of the town is by no means prepossessing. The streets are narrow, and in their upper part so steep as to be inaccessible to carriages. The principal edifices are a heavy Romanesque cathedral on a commanding height; the large church of St. Laurent, in which the Constable Du Guesclin is buried; the theatre, in an ancient octagonal building, fabled to have been a temple of Diana; a large and handsome seminary; a new prefecture, and some interesting Roman remains. The manufactures are chiefly lace, tulle, and blonde, leather, &c. Pop. (1881), 18,825.

PUY-DE-DÔME, a department of France, bounded on the north by Allier, on the west by Creuse and Corrèze, on the south by Cantal and Haute-Loire, and on the east by Loire; area, 3070 square miles. It consists of an extensive undulating valley, flanked east and west by lofty ramifications of the Cevennes. Its mountains, situated chiefly in the west, form two groups—one in the north consisting of rounded volcanic cones, generally called Monts-Domes, of which the celebrated Puy-de-Dôme, 4805 feet, is the culminating point (see CEVENNES); the other consists of lofty peaks called Monts-Dores, of which the culminating point, Puy-de-Sancy, 6225 feet, is the loftiest mountain in the interior of France. Many of the craters of these extinct volcanoes are as well marked as those of volcanoes now existing, and the streams of lava which flowed from them can be traced for miles. In the lower localities the vine is cultivated, and large quantities of wheat, hemp, and flax are grown; in the higher localities rye and oats are the principal crops; but the most valuable products are obtained from the forests, particularly the chestnut, which forms an important article of food. The loftier mountain districts abound with pastures, which are verdant almost to the mountain summits, and feed vast numbers of cattle and sheep. According to a general estimate the whole surface of the department may be thus divided—arable land, nearly one-half; waste, one-fourth; wood, rather more than one-tenth. In these districts the wild boar and deer are not uncommon, and eagles and other large birds of prey are often seen. Game is numerous. The minerals of the department are not of much importance; coal, however, is worked to advantage in several places. Mineral springs, both cold and thermal, are very numerous. The principal manufactures are hempen cloth, ribbons, camlet, bombazine, satin, lace, cards, cutlery, &c. Pop. (1881), 566,064.

PUZZOLANA. See POZZOLANA and CEMENTS.

PYÆMIA (Greek, *puon*, pus, and *haima*, blood), a disease due to the presence in the blood of the principal elements of pus, or other unhealthy secretions consisting of decomposing animal matter. The poisonous matter may be introduced through an ulcer or wound, or through an imperfectly closed vein or a mucous membrane. Two varieties of the malady are distinguished: *acute* pyæmia and *chronic* pyæmia. The former of these runs its course very rapidly, beginning with a violent fit of fever and shiverings of greater or less intensity, followed by other feverish fits of the same character, attended by great prostration, and terminating fatally at a period varying from a few hours to eight or ten days from its first appearance. Acute pyæmia resulting from an important surgical operation is almost always fatal. If violent shiverings overtake the patient twenty-four or forty-eight hours after accouchement, or after an operation, a fatal termination to the malady may be expected. Chronic pyæmia is much less serious; it continues several months, and the patient is likely to recover, unless the lesion which causes the secretion and the absorption of the pus is not itself of a very serious character. Chronic pyæmia results from the absorption of the granules and the liquid elements of the pus consequent upon bad suppurations resulting from a burn, in abscesses through congestions, white tumours, &c. It is announced by a slow continuous fever with intermittent fits and nocturnal sweats, with or without colliquative diarrhœa. If the poison has entered the system from an open sore, nitrate of silver should be applied, followed by fomentations and poultices. The bowels should be kept open by purgatives, and saline draughts should be administered daily. Stimulants and small doses of opium should be used pretty freely, in order to counteract the state of nervous depression incident on the disease, and nutritious food should be taken.

PYCNOGONUM, a genus of Annulose animals, sometimes included in an order (Podosomata) of the lower Arachnida, and at other times classified with the lower Crustaceans. These forms, popularly known by the name of 'Sea Spiders,' are all marine and of small size, and exist either as free organisms or as parasites upon fishes, whales, and other marine forms. The body is short and thick, the eight limbs being longer than the body, and remarkable as containing prolongations of the digestive system. The mouth bears a pair of mandibles provided with *chelæ* or pincer-like claws, and also contains two maxillary palpi. In the female a pair of false legs, each consisting of six joints, exist behind these palpi, and are used for carrying the ova or eggs. The head is prolonged and not provided with appendages, the thorax or chest consisting of four segments, and the abdomen is rudimentary. The eyes number four, and are placed on the first joint of the thorax. The sexes are distinct. No specialized breathing organs exist, and it is doubtful if a heart is developed. The common British species is *Pycnogonum littorale*. It is

not parasitic, and is found on our coasts at low-water mark, crawling on sea-weed or beneath stones. *P. gracile* is another species, whilst *P. Balænarum* attaches itself parasitically to whales.

PYGMALION, a prince of Cyprus, who, disgusted with the debaucheries of his countrywomen, took an aversion to the sex. According to Ovid (Met. x. 243), having made a female statue of ivory he was so enchanted by its beauty that he fell in love with his own work, and entreated Venus to endow it with life. His prayer was granted; the statue began to breathe and live before his eyes, and in his embrace. It became his wife, by whom he had Paphos, the founder of the city of the same name. Gilbert's drama of Pygmalion and Galatea is founded on this story. Another Pygmalion, King of Tyre and Sidon, was brother of Dido.

PYGMY (Greek, *pugmaios*, dwarfish). The Pygmies were a fabulous nation of dwarfs, who were said to live near the sources of the Nile, or, according to some, in India. Homer mentions them as threatened with death and destruction by the cranes (Il. iii. 3). Later writers are more minute in their accounts. Pliny says that their towns and houses were built of egg-shells; and according to Philostratus they cut down their corn, as one would fell a tree, with axes. The latter also speaks of an army of Pygmies which attacked Hercules while sleeping after his struggle with Antæus. They made such preparations for the assault as if they were to attack a city. But the hero, on awaking, laughed at the little warriors, wrapped them up in his lion-skin, and carried them to Eurystheus.

PYLADES, son of Strophius, king of Phocis, and Anaxibia, the sister of Agamemnon, celebrated for the friendship which existed between him and Orestes. He assisted Orestes in murdering his mother Clytæmnestra, and also accompanied him to the Tauric Chersonesus. He eventually married Electra, the sister of his friend. See ORESTES.

PYLORUS. See STOMACH.

PYLOS, a town of ancient Greece, in the south-west of Messenia, on a promontory at the north entrance to what is now called the Bay of Navarino. The inhabitants, after offering a brave resistance to the Spartans in the second Messenian war, were obliged to quit it with the rest of the Messenians, and the town was laid in ruins. This or another town of the same name was founded by Neleus and governed by Nestor and his descendants.

PYM, JOHN, a parliamentarian in the reign of Charles I., was descended of a good family in Somersetshire, where he was born in 1584. He was educated at Pembroke College, Oxford, whence he removed to one of the Inns of Court, and was called to the bar. He was early elected member of Parliament for Tavistock in the reign of James I., and took a prominent part in the impeachment of the Duke of Buckingham in 1626. In 1639, with several other commoners and lords, he held a close correspondence with the commissioners sent to London by the Scottish Covenanters; and when Parliament, which had not assembled since 1628, met again in 1640, Pym was one of its most active and leading members. It was not, however, till the meeting of the Long Parliament, towards the latter part of the same year, that he came most prominently to the front. Possessed of great eloquence, he made a vigorous and effective speech as soon as Parliament had opened, in which he dwelt at length upon the grievances of the nation with respect to parliamentary privileges and civil and religious liberty. He did not, however, stop here, but a few days later followed up his speech by bringing forward a charge of high treason against the Earl of Strafford, prime minister of Charles I.; and in the impeachment which followed, and which resulted in the death of Strafford, he took the leading part. In 1641 a motion was carried by the opposition party to submit a remonstrance to the king exposing the defects of his administration since ascending the throne, and it was the zeal and earnestness of Pym in this matter which led Charles into the imprudent measure of going to the Parliament in person to seize him and other four members. Pym strenuously opposed every overture of peace, and at last hostilities commenced by the breaking out of the civil war in August, 1642. Clarendon relates that Charles I., feeling the necessity of gaining at any cost an enemy at once so implacable and so skilful, offered to Pym the post of chancellor of the exchequer. We are not told what reply he made to this offer; but without being quite so virulent in his speech, he still continued the determined opponent of the king. Some time before his death he drew up a defence of his conduct, which leaves it doubtful what part he would have taken had he lived until hostilities commenced. In November, 1643, he was appointed lieutenant of the ordnance, and died December 8 of the same year. He was buried with great pomp in Westminster Abbey, his body being carried by six members of the House of Commons. The character and life of Pym have been variously judged by his contemporaries according to their sympathies. By some held in the highest admiration and esteem, he was accused by others of having often been actuated by personal animosity, and of even having accepted money from private individuals and the king himself.

PYRALIS. See MOTH.

PYRAMID, in geometry, is a solid having any plane figure for its base, and triangles for its sides, all terminating in one common point or vertex. If the base of the pyramid is a regular figure, the solid is called a *regular* pyramid, which then takes particular names according to the number of its sides, as *triangular*, *square*, *pentagonal*, &c., the same as the prism. (See PRISM.) If a perpendicular from its vertex falls on the centre of the base, the solid is called a *right* pyramid, but if not it is *oblique*. The principal properties of the pyramid may be stated as follows:—1. Every pyramid is one-third of a prism of equal base and altitude. 2. Pyramids of equal bases and altitudes are equal to each other, whether the figure of their bases be similar or dissimilar. 3. Any section of a pyramid parallel to its base will be similar to the base, and these areas will be to each other as the squares of their distances from the vertex. 4. Pyramids, when their bases are equal, are to each other as their altitudes; and when their altitudes are equal, they are to each other as their bases; and when neither their bases nor their altitudes are equal, they are to each other in the compound ratio of their bases and altitudes. The solidity of a pyramid is found by multiplying its base by its perpendicular altitude, and taking one-third of the product. *Frustum* of a pyramid is the solid formed by cutting off the upper part of a pyramid by a section parallel to its base.

PYRAMID (Greek, *puramis*), in architecture, a colossal structure of masonry having a rectangular base and four triangular sides terminating in a point, used by the ancients in various parts of the world either for sepulchres or for religious purposes. The derivation of the term is unknown. Some derive it from the Greek *pur* (fire), because the form of the pyramid is like a flame; others from *puros* (wheat, grain); while others again assign to it an Egyptian origin. According to Herodotus the Egyptians considered the pyramidal form as an emblem of human life. The broad base was significant of the beginning, and its termination in a point of the end of our exist-

ence in the present state; for which reason they made use of this figure in their sepulchres. The most remarkable pyramids are those of Egypt and Nubia and those of Mexico. The Egyptian pyramids are large, quadrangular, and hollow, having a broad base, contracting gradually towards the top, sometimes terminating in a point, sometimes in a plane surface, and built of large blocks of red or syenitic granite, or of hard calcareous stone. The four sides are so placed as to face the four cardinal points, and two of them are usually larger than the other two. Investigations conducted with a view of determining the character of these structures make it appear that they date from the period of the third dynasty to the twelfth (say 2500–2000 B.C.), after which none were built. Each pyramid was commenced over a sepulchral chamber excavated in the rock, and the work went on during the lifetime of the king for whom it was intended. A low narrow passage was kept open as the tiers of stone were added, in order that access might be obtained to the central chamber from without; and when the monarch died the work ceased, and the last layers were then finished off and the passage closed up. The angles formed by the recession of each superior layer were filled up with small stones and bevelled off, so as to give a smooth sloping surface to the sides. The stones used varied in thickness from 2 feet to 4 feet, and the mechanical skill requisite to quarry these and to raise them to such great heights and adjust them in their proper places continues a matter of universal astonishment. No indication of the mechanical contrivances used for this purpose has been left, though that they possessed such can hardly be doubted. The fact that an almost fabulous number of labourers were engaged in erecting these pyramids did not lessen the necessity for the employment of certain machines. The pyramids now standing, all in Middle Egypt, are divided into five groups, containing in all about forty pyramids. The district in which the pyramids stand begins above Dashur, and extends by Sakkara and Memphis along the western margin of the valley of the Nile for about 60 or 70 miles, the last or Gizeh group being but a few miles above Cairo. The group of Gizeh, in the neighbourhood of the ancient Memphis, is the most remarkable. It consists of nine pyramids, and comprises the three most celebrated monuments of the kind in existence, namely, the pyramid of Cheops, called the Great Pyramid; that of Cephren, and that of Mycerinus—the last much smaller than either of the two first. According to Herodotus the Great Pyramid was built by Cheops. It took 100,000 men working for ten years to make a causeway 3000 feet long, to facilitate the transportation of the stone from the Turah quarries; and the same number of men for twenty years more to complete the pyramid itself. Herodotus further describes the method of building by steps, and raising the stones from layer to layer by machines, and finally of facing the external portion from the top down. Diodorus calls the builder of this pyramid Chembes or Chabryes, and by Manetho and Eratosthenes he is called Suphis. The latter name corresponds to Shufu, deciphered from the hieroglyphics upon some stones discovered by Colonel Vyse in his important investigations of this pyramid in 1835. The pyramid at present covers an area of more than 12 acres; according to Colonel Vyse its height is 450 feet 9 inches, the base is 746 feet square, and the angle at which the sides slope 51° 50′. Wilkinson gives the present height as 460 feet, its height when entire 480 feet 9 inches. The outer casing of small stones has been removed, and the appearance the sides now present is that of a series of ascending steps. By these steps, which number 203, the ascent is made comparatively easy, though the lower ones are 4 feet 10 inches high. The content of solid masonry has been estimated at 82,111,000 cubic feet. The only entrance is on the north face, 49 feet above the base, though the masonry about it has been so much broken away that the *débris* reaches nearly up to it. A passage 3 feet 11 inches high and 3 feet 5½ inches wide conducts from the entrance down a slope at an angle of 26° 41′, a distance of 320 feet 10 inches, to the original sepulchral chamber, commonly known as the subterraneous apartment; it is carried, reduced in dimensions, beyond this a distance of 52 feet 9 inches into the rock, though for what purpose remains a matter of conjecture. The sepulchral chamber is 46 feet long by 27 feet wide, and 11½ feet high. From the entrance passage another branches off and leads to several other passages and chambers. One of the latter, known as the *queen's chamber*, is situated about the centre of the pyramid, 67 feet above the base; it has a groined roof, and measures 17 feet broad by 18 feet 9 inches long, and 20 feet 3 inches high. The other, called the *king's chamber*, is reached by an offshoot from the queen's passage, 150 feet long. Its dimensions are 34 feet 3 inches long by 17 feet 1 inch wide, and 19 feet 1 inch high. The chamber is lined with red granite highly polished, single stones reaching from the floor to the ceiling, and the ceiling itself is formed of nine large slabs of polished granite extending from wall to wall. The only contents of the apartment is a sarcophagus of red granite, which, judging by its dimensions, must have been introduced when the building was proceeding. It is supposed to have contained a wooden coffin with the mummy of the king, and that these long since disappeared when the pyramids were first opened and plundered. The second pyramid, built by Suphis II. or Cephren, stands on a higher elevation than the Great Pyramid. Its original dimensions were 707 feet 9 inches square, and 454 feet 3 inches high; but these now stand 690 feet 9 inches and 447 feet 6 inches respectively, with an angle for its slope of 52° 20′. Part of the outer casing of the pyramid is still preserved. This pyramid has two entrances, and the passages to which they respectively give access lead to the same sepulchral chamber, in which is deposited a granite sarcophagus. It was reached with great difficulty by Belzoni in 1818. Belzoni found in it a Cufic inscription recording the visit of the Calif Alaziz Othman Ben-Yusuf, and the opening by him of the pyramid in 1196 A.D. The only remains met with were those of a bull. The third pyramid, built by Menkaré or Mycerinus, is only 354 feet 6 inches square and 203 feet high. It also was explored by Colonel Vyse in 1837. He discovered several chambers, one of which contained a sarcophagus and a mummy case bearing the name of King Menkaré, and also a body, supposed to be that of an Arab. The two latter are now in the British Museum, but unfortunately the sarcophagus was lost by the sinking of the vessel in which it was being transported to this country. This pyramid is the best constructed of the three; it was originally cased half-way up with black granite. The six smaller pyramids which complete the Gizeh group are supposed to form the tombs of some of the relatives of the kings who constructed the larger ones, and are of much inferior interest to the three above mentioned. Of the other groups of pyramids that at Abusir contains five; another at Sakkara contains eleven, one with a doorway inlaid with porcelain tiles and having a royal name; and a third group at Dashur contains five. Other pyramids are at Meydun and Illahun, and there are two at Biahmu. The pyramids of Nubia are very numerous; a single group north of Gebel Barkal comprises no fewer

than 120. In Assyria the Birs Nimrud or Tower of Belus was a kind of step-shaped pyramid, built of bricks of different colours. It was erected by Nebuchadnezzar, and dedicated to the planets. Its height was 235 feet and its circumference 2286 feet. The Mujellibe in Babylon, of which the ruins are still to be seen, was another pyramidical structure of the same monarch. Ruins of pyramids are to be found at Benares in India and in other parts of the East. The singular monuments of the ancient inhabitants, found in Mexico, are also called pyramids. They are built of brick, disposed in layers alternating with clay or of a mixture of clay and pebbles, with a coating of stone overlaid with a plastering of lime, and the sides are formed into terraces, as in that of Cholula (which see). The two pyramids of Teotihuacan are considered to be of the eighth century. They are situated in the centre of the plain of Otumba, to the north-east of the city of Mexico, and are called respectively the houses of the Sun and Moon. Both consist of four terraces or stages; the height of the 'House of the Sun' is 180 feet, and of the 'House of the Moon' 144 feet. Another remarkable monument of this kind is the pyramid of Papantla, near Vera Cruz, which had been carefully concealed by the superstitious veneration of the Indians until accidentally discovered about a century ago. It is constructed of large blocks of hewn porphyry cemented with mortar, and sculptured in relief with innumerable figures, principally of serpents and alligators. Like the others before mentioned, its sides are formed into terraces, the wall above each of which contains square niches, 378 in number, being, as is supposed, intended to represent the common year and the intercalary days at the termination of each cycle. It is about 60 feet high, and has a base 80 feet broad. (See MEXICO, ANTIQUITIES OF.) Compare Lepsius, Ueber den Bau der Pyramiden, and Vyse's Operations carried on at Gizeh in 1837 (three vols. London, 1837 seq.)

PYRAMUS AND THISBE, an unfortunate pair of devoted lovers, who, as the story goes, resided in Babylon, and being prevented by the enmity subsisting between their respective parents from meeting openly, were in the habit of secretly conversing with each other through an opening in the wall, as their houses adjoined. Having agreed one day to meet at the tomb of Ninus, Thisbe, who was the first at the rendezvous, was surprised by a lioness and took to flight. In her haste she dropped her garment, which the lioness seizing covered with blood, having immediately before killed an ox. Meanwhile Pyramus appears on the scene, and concluding from the blood-besmeared robe that his mistress is no more, he takes his own life. Thisbe returning soon afterwards, and finding the body of her lover dies in like manner by her own hand. A favourite mode of expression in the middle ages in reference to a couple unfortunate in love was to call them Pyramus and Thisbe. The story appears in Ovid's Metamorphoses, and we have a caricature of it in Shakspere's Midsummer Night's Dream.

PYRENEES (Spanish, *Pirineos;* Latin, *Pyrenæi Montes*), a lofty mountain chain forming the boundary between France and Spain, and stretching across the whole of the isthmus which connects the Spanish peninsula with the rest of the European continent, and abuts with one extremity on the Mediterranean Sea, and with the other on the Atlantic Ocean. Its length, from Cape Creux, north of the Gulf of Rosas, to the Point of Figuier, near Fuenterrabia, is nearly 270 miles; and its breadth near the centre, where it is greatest, scarcely exceeds a third of the length, or 90 miles. Though the chain thus defined terminates at two opposite seas, it cannot be said to be isolated, since to the west it is obviously continued across the north of Spain by the Cantabrian Mountains. The direction of the chain is E.S.E. to W.N.W. It does not, however, lie in the same straight line, but rather consists of two lines, which form parallel ridges about 20 miles distant from each other, except near the centre, where they become united by means of a remarkable rectangular elbow, in which some of the loftiest summits are found. Both on the north and south sides numerous branches are thrown off, generally at right angles to the principal axis, and subside rapidly as they recede from it, forming various transverse, but very few longitudinal, valleys. The chain rises both from the east and west towards the centre; and, in accordance with a general rule which holds in regard to the European chains which lie in the direction of the equator, the descent on the south side is much more abrupt than on the north. Owing to this the south has much fewer lakes than the north slope, but far surpasses it in the boldness and grandeur of its scenery. As already observed, the loftiest summits of the chain are near its centre. Its culminating point, Maladetta, situated there, has the height of 11,424 feet, and a great number of peaks in the same locality exceed 8500 feet. To the east of the centre the chain lowers so rapidly that its average height soon becomes little more than 2000 feet. To the west the height diminishes much more gradually, and many peaks have heights varying from 5000 to 7000 feet, and even 8000 feet. The principal passes in the Pyrenees formed by the meeting of valleys from opposite sides of the axis, take in the east part of the chain the name of Cols, and towards the centre that of Porta. No fewer than seventy-five are counted, of which twenty-eight may be crossed on horseback, and seven in wheeled carriages. The most frequented are those of Pertus and La Perche in the east, and St. Jean Pied de Port in the west. The nucleus of the chain is evidently granite, which, with the primitive schists which overlie it, constitutes the loftiest summits, with the exception of Mont Perdu (11,168 feet), Marbore (10,050 feet), and some huge adjacent masses which are formed of mountain limestone. The granite, however, seldom forms continuous ridges along the principal axis, but rather appears in a number of remarkable protuberances situated to the north of it. Above the micaceous schist and primitive limestone, which occur in connection with it, lie largely-developed strata of argillaceous schist and transition limestone, forming two great belts parallel to the primitive chain, one on the north and the other on the south side. Above these secondary rocks appear, of which by far the most common is the mountain limestone, which occupies the greater part of the south slope, but on the north side attains little elevation, being there almost entirely confined to the lower heights at the bottom of the principal chain. Above the mountain limestone the principal rocks are Jura limestone and trap. The number of thermal springs existing in the Pyrenees seems to indicate the presence of volcanic agents, but basalt and other rocks of igneous origin are very rare. The minerals of the chain include iron, copper, lead, zinc, manganese, antimony, and cobalt. There is no mine either of silver or gold, but particles of the latter are found in department Ariége, and in the streams of several other districts. The only mineral which has hitherto been worked to much advantage is iron. Mineral springs, both cold and thermal, are numerous, and much frequented by visitors. The limit of vegetation on the Pyrenees is about 600 feet higher than on the Alps. The rhododendrons, which in the latter are not found higher than 5000 feet, are here found at 5500 feet, and alpine plants are found on

the loftiest summits bordering on the region of perpetual snow. In the Pyrenees this is found only on the north slope, where it does not, as in the Alps, form a snowy zone, the lower limit of which looks as if traced out by an almost horizontal straight line; but, on the contrary, forms large isolated masses, the base of which is often concealed by the mountains in front of them. This makes it difficult to fix the snow-line with precision, but according to the most accurate estimate it is 9190 feet, or nearly that of Mount Canigou. Glaciers are not numerous in the Pyrenees, and hence the torrents and rivers which rise in the chain are fed chiefly by springs. Those on the south side flow towards the Ebro, and are carried by it to the Mediterranean; those on the north side flow partly to the Mediterranean, and partly to the Atlantic; the water-shed between the two seas being not formed throughout by the central ridge, but only westward as far as Corbières, when the water-shed changes its direction, and is carried northward by a branch which ultimately links with the Cevennes. The largest river of the chain, and the only one of importance which preserves its name throughout its whole course, from its source to its mouth, is the Garonne. In respect of average height and mass the Pyrenees is unquestionably the second mountain chain of Europe, but its culminating point, Maladetta, has only the third place; the first belonging to Mont Blanc, and the second to the Cerro de Mulhaçen in the Sierra Nevada in the south of Spain, which is nearly 200 feet higher than Maladetta. (But see the article CAUCASUS.) Contrary to the general rule that the loftiest summits of mountain chains are found in the line of the principal axis, Maladetta, Posets (11,277 feet), and Mont Perdu, the three culminating points of the Pyrenees, are situated on the south slope.

PYRENEES, PEACE OF THE, concluded between France and Spain by Mazarin and De Haro, on the Isle of Pheasants, in the river Bidassoa, on the borders of the two countries, 7th November, 1659. By this treaty Spain ceded to France Roussillon, with the fortress of Perpignan, Conflans, and a part of the Cerdagne, so that the Pyrenees have since formed the boundary of the two kingdoms; and in the Netherlands, Artois, and part of Flanders, Hainault, and Luxemburg, with the fortified towns of Arras, Hesdin, Gravelines, Landrecy, Quesnoy, Thionville, Montmedy, Marienburg, and Philippeville. In 1815 France was obliged to cede the two last-named fortresses to the Kingdom of the Netherlands.

PYRENÉES-BASSES, a department of France, in the south-west, bounded on the north by Gers and Landes, on the west by the Bay of Biscay and Spain, on the south by the Pyrenees, and on the east by the department Hautes-Pyrénées; area, 2943 square miles. It consists of the lower slopes of the Pyrenees, which extend from the south with a general slope north-west. The surface is finely diversified and often very picturesque. The Pyrenees shutting in the department on the south, and remaining long covered with snow, produce sudden changes of temperature, and send down cold winds, which often prove very injurious to vegetation after the season has far advanced. The soil is generally indifferent, and the ruggedness of the surface is very unfavourable to cultivation. Not much less than one-half of the whole surface is waste, and little more than one-fifth arable. The most valuable products are furnished by the extensive forests which clothe the mountain steeps; but good wheat, maize, and flax, the last furnishing the material of the fine Béarn linens, are grown in the more favoured localities. Minerals are of little consequence. The capital is Pau. Pop. (1881), 434,366.

PYRÉNÉES-HAUTES, a department of France, in the south, bounded on the north by Gers, on the west by Basses-Pyrénées, on the south by the Pyrenees Mountains, and on the east by Haute-Garonne; area, 1749 square miles. It is covered in the south with some of the loftiest summits of the Pyrenees, and even near its centre the Pic-du-Midi-de-Bigorre rises to the height of 9587 feet. The scenery is often very magnificent. The climate is very variable, and the surface, partly from the indifferent nature of the soil, but still more from its ruggedness, is ill adapted for cultivation. Little more than one-fifth of the whole is arable, and of this the larger part occurs on the beautiful plain of Bigorre. The vine is partially cultivated on the lower slopes, but the principal source of revenue is the extensive forests. The pastures are excellent, and rear horses well adapted for light cavalry, mules, asses, horned cattle, and swine. The last furnish the famous hams of Bayonne. Pop. (1881), 236,474.

PYRÉNÉES-ORIENTALES, a department of France, in the south-east, bounded on the north by Aude, on the north-west by Ariége, on the south-west and south by Spain, and on the east by the Gulf of Lyons; area, 1592 square miles. On the south and west it is hemmed in by the chain of the Pyrenees, and traversed by ramifications forming parallel valleys, which stretch from west to east, and send their waters to the Mediterranean by the Agly, Tet, and Tech. The climate is on the whole excellent, though the winds are very inconstant, often suddenly succeeding each other, and blowing with equal violence from opposite directions. Nearly a half of the whole surface is waste, and the arable portion, which is less than a fourth, is by no means naturally fertile. Astonishing results, however, are produced by irrigation, particularly on the lower grounds where it can be most successfully applied, and heavy crops of corn and maize, and luxuriant cuttings of lucerne, are obtained. By means of the latter large numbers of live-stock are maintained. The vine is cultivated to some extent, and produces, among other wines of good name, that of Rousillon. The only important mineral is iron, which is extensively smelted and manufactured. The capital is Perpignan. Pop. (1881), 208,855.

PYRHELIOMETER, an instrument for measuring the intensity of the heat of the sun. A shallow, circular vessel of silver, having one side coated with lampblack, containing mercury or water, and having a thermometer let into it, is the pyrheliometer of M. Pouillet. Suppose the apparatus to have the temperature t of the atmosphere; let it indicate t' after five minutes' exposure of the blackened side to the clear sky, the instrument being in the shade; let T be the temperature after five minutes' exposure of the blackened side to the direct rays of the sun, and T′ the indication after another five minutes in the shade. The total effect E of the sun is given by—

$$E = T - t' + \frac{t - t' + T - T'}{2}.$$

$T - t'$ is the apparent elevation of temperature after five minutes of direct sun, and $\frac{t - t' + T - T'}{2}$ is the mean radiation during that five minutes. From E may be calculated the quantity of heat received by the mass in the ordinary heat units, by taking into account the specific heats of the silver and mercury; the area of the exposed surface is known, and thus the heating effect of the sun on a given area may be determined.

PYRIDINE (C_5H_5N), a mobile liquid, boiling at 117°, obtained by the distillation of various organic substances, such as peat, bone, coal naphtha, &c.

Pyridine has an alkaline reaction, and forms salts with acids.

PYRITES, a name given in mineralogy to various metallic sulphides, chiefly to the sulphides of copper and iron. Pyrites is largely used as a source of sulphur in the manufacture of sulphuric acid. See the articles COPPER, IRON, and SULPHUR.

PYRITZ, an ancient town of Prussia, in the government of Stettin, and 24 miles south-east of the town of that name, on an affluent of the Plön. The town was a place of great strength under the Wends, by whom five high towers standing on the town-walls were built. Pyritz has several courts and public offices, two churches, a town-house, and three hospitals; a fishery, and a trade in cattle. Near it is a fountain, in which in 1124 Otho of Bamberg is said to have baptized 7000 Pomeranians. Pop. 8123.

PYRMONT. See WALDECK AND PYRMONT.

PYRMONT, a celebrated watering-place of Prussia, in the Principality of Waldeck and Pyrmont, capital of the district, in a beautiful valley at the foot of a range of finely-wooded hills, on the left bank of the Emmer, 34 miles S.S.W. of Hanover. It is a small but well-built place, with several fine promenades, and consists of an open square and a long street lined with linden-trees. It contains a palace, in which the Prince of Waldeck and Pyrmont resides during the watering season; and a very complete bathing establishment, which is much frequented, particularly by the aristocracy of Germany; from 10,000 to 12,000 visitors resort hither annually. The water is chalybeate, possessing valuable medicinal properties; it is strongly impregnated with carbonic acid gas, and produces an exhilarating and even intoxicating effect. About 55,000 bottles of water are annually exported. One of the curiosities of the place is the Dunsthöhle or gas grotto, which emits vapours similar in nature and effect to those of the Grotto del Cane in Italy. The bathing establishment has the usual accompaniments of theatre, ball-rooms, &c. Pop. (1881), 1401.

PYROLIGNEOUS ACID, an impure acetic acid obtained by the distillation of wood. The wood is heated in large iron cylinders connected with a series of condensing vessels. The liquid which collects in these vessels is composed of tar, water, wood-spirit or methylic alcohol, acetic acid, &c. The watery liquid is separated and redistilled, when the wood-spirit passes over first, and the pyroligneous acid at a later stage of the distillation. For the method of purifying this crude acid see VINEGAR.

PYROMETER, an instrument for measuring temperatures higher than the boiling-point of mercury (350° C.) Regnault and other careful experimenters employed the expansion of air and vapours in measuring high temperatures. These pyrometers can only be employed in a laboratory; for use in a manufactory less accurate methods of measurement have to be employed. In Wedgwood's pyrometer (1782) it was assumed that dry clay, when exposed to heat, contracted regularly, and the instrument was constructed on this principle; but it is now known to be untrustworthy. An instrument in which the expansion of a metal bar (generally of platinum) was magnified by means of levers has often been employed to measure the temperature of a furnace. Morveau, Brongniart, and Daniell invented instruments on this principle. The thermo-electric law of Professor Tait may be used to calculate the temperature to which a junction of copper and iron has been subjected, the electric current produced being measured by a galvanometer. The author has in this way been able to measure high temperatures with considerable accuracy. Mr. Siemens measures temperatures by observing the increased electric resistance of a platinum wire when it becomes heated. Two coils of the same kind of wire are prepared so as to have equal resistances at the same temperature. Their ends are connected by pretty long thick copper wires, and the current from a constant battery passing through them is measured by means of a galvanometer. One of the coils is kept at a known temperature, the other has the temperature which we want to measure. The law discovered by Mr. Siemens—

$$R = \alpha \sqrt{T} + \beta T + \gamma$$

where R is the resistance at the *absolute* temperature T, and where α, β, and γ are certain numbers, enables the temperature to be calculated. Pouillet determined the following temperatures by means of an air thermometer. They correspond to the stages of incandescence of a metal bar.

Incipient red-heat,	525° C.
Dull red,	700°
Cherry red,	900°
Dark orange,	1100°
White,	1300°
Dazzling white,	1500°

PYROPHORUS, a name applied to certain substances which take fire when exposed to the air. The most common pyrophorus consists of finely-divided metallic lead or iron, produced by heating the tartrate of these metals in a glass tube in a stream of coal-gas or of hydrogen, whereby the salt is decomposed, and the metal is left in the tube in a very finely-divided state. The tube is sealed while filled with coal-gas. On breaking open the tube and shaking its contents into the air, or into a jar of oxygen, the particles of the metal are oxidized, with evolution of heat and light.

PYROSOMA, a genus of Tunicata or Ascidian Molluscs (see MOLLUSCA and TUNICATA) forming the type of the family Pyrosomidæ, and included among the free-swimming or oceanic members of the Tunicate class. Pyrosoma is a *compound* organism, and consists of an elongated cylindrical tube closed at one extremity, and formed by the aggregation of an immense number of zoöids or individuals. The branchial apertures open externally, the atrial orifices opening in the interior of the cylinder. The name Pyrosoma ('fire-body') is derived from the brilliant phosphorescent light emitted by these forms, the Pyrosomæ at night appearing each as a glowing lambent mass of flame. They chiefly occur swimming on the surface of the ocean in warm latitudes. Several species are known, of which *Pyrosoma atlanticum*, *P. elegans* of the Mediterranean, and *P. giganteum*, also found in the latter sea, are the most familiar. See also PHOSPHORESCENCE (ANIMAL).

PYROTECHNY, the term applied to the composition, structure, and use of artificial fire-works. The ingredients are nitre, sulphur, and charcoal, together with filings of iron, steel, copper, zinc, and resin, camphor, lycopodium, &c. Gunpowder is used either in grain, half crushed, or finely ground, according to the desired effect. The proportions of the materials differ very much in different fire-works, and the utmost care and precaution are necessary when working them into a state fit for use, and then in the mixing. The longer the iron-filings, the brighter red and white sparks they give. Steel-filings and cast-iron borings contain carbon, and give a more brilliant fire with wavy radiations. Copper-filings give flame a greenish tint, those of zinc a fine blue colour; the sulphuret of antimony gives a less greenish blue than zinc, but with much smoke; amber, resin, and common salt (which must be very dry) give a yellow fire. Lampblack produces a very red colour with gunpowder, and a pink with nitre in excess. It serves for making golden showers; yellow micaceous sand serves for the same purpose. Verdigris imparts a

pale green, sulphate of copper and sal-ammoniac a palm-tree green. Camphor produces a very white flame, with aromatic perfumes, which mask the bad smell of the other ingredients; benzoin and storax are also used on account of their agreeable odour. Lycopodium, which is often used in the manufacture of stage-lightning, burns with a rose colour and a magnificent flame. For full information as to the various processes in the manufacture of fire-works see Dr. Ure's Dictionary of Arts and Manufactures, &c.

PYROXYLIC SPIRIT, a common name for methylic alcohol or wood-spirit. See METHYL.

PYRRHA. See DEUCALION.

PYRRHIC DANCE, one of the most famous war-dances of antiquity. It was danced to the sound of the flute, and its time was very quick and light, as may be seen from the nature of the Pyrrhic foot. (See RHYTHM.) In the Doric states it was as much performed for the purpose of military training as for amusement. We learn from Plato that its aim was to represent the rapid motions of soldiers avoiding missiles or blows, darting upon or from the enemy. In the non-Doric states it was purely a mimetic dance, and frequently performed by women. It was introduced into the Roman public games by Julius Cæsar, and was danced by the children of the leading families in Asia and Bithynia. In the mountainous districts of Thessaly and Macedonia a dance called the Romaika, which is supposed to be a modern relic of the Pyrrhic dance, is performed at the present day by men armed with muskets and swords.

PYRRHIC FOOT, or PYRRHICHIUS. See RHYTHM.

PYRRHO (Greek *Purrhōn*), a Grecian philosopher of Elis, founder of the Pyrrhonian or ancient sceptical school, flourished about 340 B.C., and was probably born about the 101st Olympiad. In his youth he studied the art of painting, but was early led to apply himself to philosophy by the writings of Democritus. We learn from Diogenes Laertius that he accompanied his master, Anaxarchus, to India, in the train of Alexander the Great. During this journey he became acquainted with the doctrines of the Brahmans, Magi, and other eastern philosophers. His doubts concerning positive knowledge (or his scepticism) were strengthened as he proceeded in his studies, until at length he came to hold all knowledge uncertain, and considered virtue alone as valuable. In all disputes his answer to his opponents was, 'What you say may, or may not, be true; I cannot decide;' and he taught in his school that truth could not be attained, and that we must be content to suspend our judgment on all subjects. He spent a great part of his life in solitude, and by abstaining from all decided opinions concerning moral and physical phemena, he endeavoured to attain a state of tranquillity not to be affected by fear, joy, or sorrow. He bore corporal pains with great fortitude, and no danger could disturb his equanimity. In disputation he was distinguished for acuteness of argument and clearness of language. His countrymen made him high-priest, and exempted all philosophers from the payment of taxes. Pyrrho died in the ninetieth year of his age. The Athenians erected a statue in honour of him, and his countrymen raised a monument to his memory. His scepticism is easily accounted for. He early became acquainted with the system of Democritus, who held that except the immediate elements of bodies (atoms) nothing was real, and that all perception was subjective. He was confirmed in these views by the doctrines of Socrates, to whom, in his character, he bore a great resemblance. Cicero mentions him expressly among the disciples of Socrates, and his scepticism is allied to the irony of that philosopher. Led by his temperament and his manner of life to esteem an uninterrupted tranquillity the great object of all philosophy, believing that nothing tended so much to destroy this quiet as the interminable disputes of the schools of the Dogmatists, and that uncertainty was increased by their contentions, he determined to seek in some other way the peace which he despaired of finding in dogmatical philosophy. This made him a sceptic. Pyrrho left no writings. His friend and scholar, Timon, first wrote on the subject of scepticism, but his writings are lost. It is only from the works of his later followers, particularly Sextus Empiricus, that we learn the principles of his school, or rather their mode of thinking, by which they strove rather to overthrow other philosophical structures than to build up one of their own. A disposition to doubt is often called, from this philosopher, *Pyrrhonism*.

PYRRHUS, King of Epirus, was born about 318 B.C. He was the son of Æacides, who traced his descent from Pyrrhus, son of Achilles; he was also connected with the royal family of Macedon, and seems to have been early possessed of the desire to rival the exploits of the conquerors who sprang from that house. His father having been deposed by his subjects, Pyrrhus was brought at the age of two years to Glaucias, king of the Taulantians, who educated him with his own children. Ten years later Glaucias marched into Epirus at the head of an army, and placed Pyrrhus on the throne. In the course of four or five years the young king was expelled, and went to the court of Antigonus, king of Syria, where he became the friend of his son, Demetrius Poliorcetes, whom he accompanied on the fatal campaign closed by the battle of Ipsus (301 B.C.), in which Antigonus fell and his army was defeated. Pyrrhus, who had fought with great bravery in the battle, then proceeded to Egypt as a hostage for Demetrius, and there married Antigone, daughter of Queen Berenice. With the aid of Ptolemy Soter he recovered his kingdom (296), agreeing to share the sovereignty with Neoptolemus, who had been king since his expulsion. Pyrrhus soon after had his colleague put to death, and succeeded by his daring courage, affability, and generosity in gaining the admiration of his soldiers and people. He made an attempt to conquer Macedonia, and did obtain a share of the throne with Lysimachus, but in 286 was driven out of the country after a reign of seven months. He thereupon returned to Epirus, where he reigned quietly for several years; but in 280 he passed over into Southern Italy at the head of a large army to assist the Tarentines, at their request, in their war against the Romans. The first battle in which the Roman legion met the Greek phalanx was fought near Heraclea, on the Siris; and the consul M. Valerius Lævinus was defeated by Pyrrhus, whose elephants played an important part in the conflict. The loss the victory entailed upon him was, however, very severe, and he made proposals of peace to the senate, which were rejected, chiefly in consequence of the spirited appeal of the old censor Appius Claudius. Pyrrhus advanced upon Rome, but finding his enemies still unwilling to treat, and considering himself too weak to attack the city, he returned, after having approached within 24 miles of it, to Tarentum, where he wintered. There he received the famous embassy, headed by Caius Fabricius, sent to negotiate for the release of the Roman prisoners. (See FABRICIUS.) In 279 he again defeated the Romans, under P. Decius Mus and P. Sulpicius Saverrio. He lost so heavily in the battle that he was glad to accept the offered truce, and passed with his army into Sicily, where for two years he assisted the Greeks against the Carthaginians. At first he met with brilliant success; but his attack upon Lilybæum having failed, he lost popularity

with the Greeks, and returned to Italy in the autumn of 276. The war was renewed, and ended in the following year with the total defeat of Pyrrhus by the Romans under Curius Dentatus, near Beneventum. He reached Epirus with a small remnant of his once splendid army. Nothing daunted by his losses, he again invaded Macedonia, and became its king a second time. He afterwards turned his arms against Sparta, but was driven from before the walls of that city. In a night attack he made upon Argos he was stunned and dismounted by a tile thrown by a woman from the house-top, and being recognized by the enemy's soldiers was quickly despatched, 272 B.C.

PYTHAGORAS, a Grecian philosopher, founder of the Italian school. According to the most received opinion, he was a native of Samos. His father, Mnesarchos, was a merchant (probably of Tyre or some other Phœnician city), who traded to Samos, where he received the rights of citizenship, and settled with his family. The year of Pythagoras's birth is uncertain; probably it took place about 584 or 586 B.C. His history is mingled with many fables. He received his first instruction from Creophilus in his native city. He then went to the island of Scyros, and was a scholar of Pherecydes till the death of the latter; others make him also a scholar of Thales and Anaximander. Iamblichus says that Pythagoras, during his journey to Egypt, spent some time in Phœnicia in intercourse with the successors of Moschus, and other priests of the country, by whom he was initiated into their mysteries, and that he travelled through various parts of Syria in order to become acquainted with the most important religious usages and doctrines. But this account is blended with many fabulous circumstances. Pythagoras is said to have been recommended by Polycrates, king of Samos, to the Egyptian king Amasis. In Egypt he was probably initiated into the mysteries of the priests, and became acquainted with the whole range of Egyptian learning. He remained in Memphis and Thebes twenty-two years (547–525), and was still in Egypt when that country was conquered by Cambyses. Like many other of the sages in that kingdom, he was carried captive to Babylon, where he enjoyed the intercourse of the Persian and Chaldean Magi; and is said to have travelled as far as India, and visited the Gymnosophists. After his return he opened a school at Samos, in which he taught his doctrines in a symbolic form, in imitation of the Egyptians. Tradition, moreover, relates that he went to Delos, and received from the priestess Themistoclea moral maxims, which he communicated to his disciples under the name of *divine precepts*. He also visited Crete, where the priests of Cybele took him to the caverns of Ida, in which Jupiter had been cradled. Here he met Epimenides, who boasted of having intercourse with gods and the gift of prophecy, and whom he initiated into the sacred mysteries of the Greeks. From Crete he is said to have gone to Sparta and Elis, and from thence to Phlius, where, being asked by King Leon what was his profession, he replied that he was a philosopher (or lover of wisdom), declaring that the name of sage (*sophos*) belonged solely to the Divinity. With augmented knowledge he returned home, where he now founded a philosophical school with great success. His doctrines seemed divine oracles; and the sacred obscurity in which he had the art of veiling them attracted a great number of disciples. He resolved, nevertheless, to leave Samos, either to avoid the public offices conferred upon him or the tyranny of Polycrates, and went to Magna Græcia. He eventually settled at Crotona, attracted, as Grote supposes, by the celebrity of that city for the cultivation of the art of medicine. From all traditions it may be concluded that he laid claim to supernatural powers, and his extraordinary qualities gained over great numbers to enter into his views. His adherents belonged to the noble and wealthy classes. Three hundred of these were formed into a select fraternity or order, which has been frequently compared with the still more famous order founded by Loyola in modern times. The members were bound by a vow to Pythagoras and each other, for the purpose of cultivating the religious rites and ascetic observances of their master, and of studying his system of philosophy. They thus formed at once a philosophical school and a religious order, which in time assumed the character and exercised the influence of a political association also. This influence, which became very considerable, was constantly exerted in the interest of the aristocratic party. The democratic party (perhaps, also, at times, an unfriendly aristocratic faction) reacted against the growing power of the order. At the head of this opposition party in Crotona was Cylon, a rich and respectable citizen, whose enmity Pythagoras had excited by refusing to receive him among his scholars. In revenge Cylon once attacked the house of Milo, where a number of Pythagoreans were assembled, surrounded it with his partisans, and set it on fire. Forty persons perished, and but few escaped. Pythagoras was probably not in the house. Other authorities set down this event long after the death of Pythagoras, who, they say, was simply banished by Cylon to Metapontum. He fled to the Locrians, and when these refused to receive him, to Metapontum, where, according to tradition, he perished from want of sustenance, eighty years of age (about 506 B.C.) His scholars are said to have paid him divine honours after his death. He is said to have asserted that his soul had already lived in several bodies, among others those of Euphorbus, a Trojan hero, of a courtezan, and a poor fisherman. In public he appeared in the oriental costume, in a long white robe, with a flowing beard, and, as some say, with a crown of gold on his head. His exterior, was grave, commanding, and dignified. He abstained, it is related, from all animal food, and limited himself to vegetables, not, however, eating beans. To show his respect for marriage he took a wife at Crotona, by whom, among several children, he had two sons, Telanges and Mnesarchus, who were his scholars and successors. That Pythagoras left any works is improbable on the testimony of the ancients. The Golden Sentences, extant under his name, which may be considered as a short abridgment of his popular doctrines, appear to have been composed by later hands. Like those of the Egyptian priests, his doctrines were of two kinds, public and secret. His public instruction consisted of practical discourses, in which he recommended virtue and dissuaded from vice, with a particular reference to the various relations of mankind, such as those of husbands and wives, parents and children, citizens and magistrates, &c. His hearers at these lectures must not be confounded with the members of his society, whom he subjected to a separate discipline, and not till after long instruction and severe examination admitted to all the mysteries of his secret doctrines. These scholars were required to practise the greatest purity and simplicity of manners. He imposed upon them, it is said, but on no good authority, a silence of two to five years, according to circumstances (the Pythagorean silence). For a time the disciples were only hearers. The well-known 'He said so' (*autos epha—ipse dixit*) was sufficient authority, without any proof. He alone who had passed through the appointed series of severe trials was allowed to hear the word of the master in his immediate presence. Whoever was terrified by the difficulties might with-

draw without opposition, and his contributions to the common stock were repaid, a tomb was erected to him as if he were dead, and he was no more thought of. To the members of the secret society the doctrines were not delivered, as to others, under the mask of images and symbols, but unveiled. These secrets probably related to religious and political subjects. It was requisite, however, to take an oath of secrecy. The pupils could now interrogate and make objections. They were called, by way of distinction, *Pythagoreans*. As soon as his disciples had made sufficient progress in geometry they were introduced to the study of nature, to the investigation of fundamental principles, and to the knowledge of God. Others, according to their inclinations and capacities, were instructed in morals, economics, or politics, and afterwards employed either in managing the affairs of the society, or sent abroad to inculcate and bring into practice the principles of philosophy and government in the other Grecian cities. According to the accounts of later writers, the mode of living at the Pythagorean school at Crotona was the following: The Pythagoreans, with their wives and children, lived together in a public building, in perfect harmony, as if one family. Each morning it was decided how the day should be spent, and every evening a review was made of all that had been done. They rose before the sun, in order to worship it; verses from Homer and other poets were then recited, or music was introduced, to rouse the mental powers, and fit them for the duties of the day. Several hours were then spent in serious study. A pause followed for recreation, in which a solitary walk was usually taken, to indulge in contemplation; a conversation then took place. Before dinner various gymnastic exercises were performed. The common meal consisted principally of bread, honey, and water. The remainder of the day was devoted to public and domestic affairs, conversation, bathing, and religious performances. After the destruction of the association, and the flight of his scholars from Lower Italy, Lysis and Archippus deemed it necessary to collect the doctrines of their master in a systematic treatise, and preserve them from oblivion; but the greatest secrecy was nevertheless recommended.

Among the authorities for the doctrines of Pythagoras or his immediate followers the indications furnished by Aristotle are the most important. Of still greater value for our knowledge of the Pythagorean system would be the fragments (collected by Böckh) of the work of Philolaus, a contemporary of Socrates, in case their authenticity were assured. All other pretended philosophical writings or fragments of writings by ancient Pythagoreans are spurious. The contents of the fragments attributed to Philolaus harmonize in many respects with the testimony of Aristotle, and give, besides, a much more concrete conception of the system; yet there is mingled with them much that is of later origin. Plato and Aristotle seem to have had no knowledge of any other than oral utterances of Philolaus. Only their statements, and in part those of the earlier Aristotelians, but no later ones, are trustworthy. Timon the Sillograph says that Plato bought at a high price a small book, on which he founded his dialogue Timæus; but it is doubtful what work is meant—probably a work of Archytas the Pythagorean. Hermippus says that this book was written by Philolaus. Under these circumstances it is impossible to discriminate with any degree of accuracy between the doctrines of the master and those of his scholars. Pythagoras resembled the philosophers of the Ionic school, who undertook to solve, by means of a single primordial principle, the problem of the origin and constitution of the universe as a whole. His predilection for mathematical studies led him to trace the origin of all things to number, his theory being suggested, or at all events confirmed, by the observation of various numerical relations or analogies to them in the phenomena of the universe. Numbers are in his view the first and most essential of things. They are, as it were, the model according to which the world is formed in all parts. The odd numbers are limited and perfect; the even unlimited and imperfect. The *monad* or unity is the source of all numbers. The *dyad* is, according to the later Pythagorean doctrines, imperfect and passive, and the cause of increase and division. The *triad*, compounded of the monad and dyad, partakes of the nature of both. The *tetrad*, or number four, is in the highest degree perfect. The *decad*, which contains the sum of these four numbers, and is therefore called *tetractys*, comprehends all musical and arithmetical proportions, and denotes the system of the world. The real meaning of the Pythagorean doctrine of numbers is not well understood; numbers were probably in this system the symbolical or allegorical representations of the first principles or forms of nature. As Pythagoras could not express abstract ideas in simple language, he seems to have made use of numbers, as geometers do of a diagram, to assist the comprehension of his scholars. He perceived some analogies between numbers and the attributes of the divine understanding, and made the former the symbols of the latter. As the numbers proceed from the monad or unity, undergo various combinations, and in their progress assume new properties, so he regarded the pure and simple essence of the Deity as the common source of all the forms of nature, which, according to their various modifications, possess different properties. Pythagoras is also said to have invented the abacus, thence called the *Pythagorean table*. Next to numbers, music belonged to the preparatory exercises of the Pythagorean school, by which the mind was elevated above the dominion of passion, and fitted for contemplation. Pythagoras considered music not only as an art to be judged of by the ear, but as a science to be reduced to mathematical maxims and relations, and allied to astronomy. Tradition makes him the inventor of a musical instrument (Pythagorean lyre, *octochordum Pythagoræ*), which, after his death, was engraved in brass, and preserved in the Temple of Hera at Samos. The invention of the harmonic canon or monochord, an instrument of a single string, which served for the measurement of musical intervals, has also been ascribed to him by ancient and modern writers. There is also a celebrated story of his having discovered the arithmetical relations of the musical scale by observing accidentally the various sounds produced by hammers of different weights striking upon an anvil, and suspending by strings weights equal to those of the different hammers. Those who retailed this story never took the trouble of verifying the experiment, or they would have found that hammers differing in weight striking on the same anvil no more produce tones higher or lower in pitch than do different clappers from one bell. He believed that the heavenly spheres in which the planets move, dividing the ether in their course, produced tones, and that the tones must be different according to their size, velocity, and distance. That these relations were in concord, that these tones produced the most perfect harmony (music of the spheres), he necessarily believed, in consequence of his notions of the supreme perfection of the universe. This harmony, however, we do not hear, either because we have been accustomed to it from the first, and have never had the opportunity of contrasting it with stillness, or because the sound is so loud as to exceed our capacities for hearing. Geometry, which he had learned

in Egypt, he reduced more than any of his predecessors and contemporaries to the form of a regular science. According to his notion the geometrical point was simple, the line double, the area threefold, and solids quadruple; and in this way also he applied the doctrine of numbers. Of the geometrical theorems which are ascribed to him the following are the most important:—The three angles of a triangle are together equal to two right angles, and in a right-angled triangle the square of the hypothenuse is equal to the sum of the squares of the two sides. This last is still called the *Pythagorean theorem* (also *magister matheseos*), though it is doubtful whether Pythagoras discovered it. In astronomy he taught the following:—Agreeably to the arithmetical hypothesis there are ten heavenly spheres, of which nine are visible to us, namely, the sphere of the fixed stars, the seven spheres of the seven planets (including the sun and moon), and the sphere of the earth. The tenth sphere, called by him Antichthon (anti-earth), is invisible, but necessary to the perfection of the harmony of nature, since the decad is the perfection of the numerical harmony. By this anti-earth he explains the eclipses of the moon. In the middle of the universe is the central fire, the principle of warmth and life. The earth is one of the planets moving around the sphere of fire, and according to the later Pythagoreans revolving on its own axis also. The atmosphere of the earth is a gross immovable mass, but the ether is pure, clear, always in motion, and the region of all divine and immortal natures. The distances of the various heavenly spheres from the earth correspond to the proportions of the musical scale. His moon and stars are gods, or inhabited by gods. His disciples Philolaus, Archytas, Ecphantus, Ocellus, Timæus, carried these speculations farther. Philolaus in particular distinguished himself by his astronomical system. With mathematics were also connected the natural sciences. With respect to philosophy Pythagoras taught that true knowledge embraced those subjects which are in their nature immutable, eternal, and indestructible, and of which alone it can be properly predicated that they exist. He who devotes himself to this study is a philosopher. The object of philosophy is by contemplation to render the human mind similar to the divine, and make it fit to enter the assembly of the gods. For this purpose it is necessary to invoke in prayer the assistance of the divinity and good dæmons. Contemplative wisdom cannot be fully attained without entire abstraction from common things, without entire tranquillity, and freedom of mind. Hence the necessity of founding a society separate from the world for contemplation and study. The theoretical philosophy of Pythagoras, which treats of nature and its origin, was enveloped in the most profound obscurity, and we know nothing of it but what may be conjectured from single intimations of the ancients. In the opinion of Pythagoras God is the universal spirit, diffused in all directions from the centre, the source of all animal life, the actual and inward cause of all motion, in substance similar to light, the first principle of the universe, incapable of suffering, invisible, indestructible, and to be comprehended by the mind alone. To the Divinity there were subordinate, according to the notions of the Pythagoreans, three kinds of intelligences—gods, dæmons, and heroes, emanations of the supreme God, varying in dignity and perfection in proportion as they were more or less removed from their source. The heroes he believed to be clothed with a body of subtile matter. Besides these three kinds there was a fourth—the human mind, likewise an emanation of the Divinity. As God is one, and the origin of all variety, he was represented as a monad, and the subordinate spirits as numbers derived from and contained in unity. Thus the numbers of Pythagoras resembled the ideas of Plato, excepting that they are contained in the things themselves. The regions of the air the Pythagoreans thought filled with spirits, dæmons, and heroes, who were the cause of health or sickness to men and animals, and by means of dreams and other kinds of divinations imparted the knowledge of future events. The soul, according to him, was likewise a number, and by numbers it first has perception, as Philolaus says, of the world; it is an emanation of the central fire, and consequently always in motion and indestructible. Of man the Pythagoreans believed, at least the later, that since he consisted of an elementary nature, of a divine or rational principle, he was a microcosm; that his soul was a self-moving principle, and consisted of three elements—Reason, an emanation of the central fire; and Intelligence and Passion; the first being distinctive of man, the two last being common to man and brutes; that the sensitive soul (*thumos*) perishes, but that the rational mind (*phrenes, nous*) is immortal, because it has its origin in an immortal source; that the latter, when freed from the fetters of the body, assumes an ethereal vehicle, and passes to the habitations of the dead, where it remains till it returns to the world to dwell in some other human or animal body. Souls under the dominion of sensuality either passed into the bodies of animals, or were cast down to Tartarus to meet with expiation or condign punishment. The pure were exalted to higher modes of life, and at last attained to incorporeal existence, being merged in the source from which it proceeded. This doctrine of the transmigration of souls (metempsychosis), which was originally Egyptian, and connected with the idea of the reward and punishment of human actions, was the chief cause why the Pythagoreans killed no animals. His morality Pythagoras taught in symbolic maxims and ascetic precepts in connection with his contemplative views. Virtue was regarded as a harmony of the soul, a conformity with or an approximation to God; self-restraint, sincerity, and purity of heart were especially commended; and conscientiousness and uprightness would seem to have been the characteristics of the earlier Pythagoreans. The Pythagorean philosophy had a great influence on the Platonic. In later times it was revived and intermingled with Neo-Platonism. See Geschichte der Pythagoräischen Philosophie, by Ritter; Lewes's Biographical History of Philosophy; Grote's History of Greece; &c.

PYTHEAS, a native of the Greek colony of Massilia, now the French Marseilles, is supposed to have lived about the time of Alexander the Great or a little later, and acquired great celebrity as a navigator, though the loss of his works, and the short and ambiguous accounts furnished by others, especially Strabo and Pliny, make it very difficult to determine the extent of his merits. Two principal voyages are ascribed to him. In the one he sailed along the west coast of Europe, entered the English Channel, landed, and travelled to some distance in Britain, and then continuing his course northward, after six days' sail north of Britain, arrived at Thule, where, during the summer solstice, the sun never disappears. This description seems to make Thule identical with Iceland. He was prevented from proceeding farther, apparently by dense fogs, which, in the fabulous spirit of his age, he has described in a manner which has been allowed to throw too much discredit on his general statement. He says that at Thule there was neither land, air, nor sea, but something compounded of them all—a molluscous substance in which earth, sea, and the whole universe were suspended. His second voyage proceeded, like his first, along the west

coast of Europe, and then through the English Channel into the German Ocean; but instead of afterwards continuing northward he appears to have crossed over to the coast of Denmark, and found his way into the Baltic, where he proceeded as far as a river which he called Tanais (which cannot be identified), and on the banks of which amber was found. Pytheas had the reputation of being a good mathematician, and is said to have determined the sun's meridian altitude at Marseilles at the summer solstice by means of a gnomon or sun-dial.

PYTHIAN GAMES, one of the four great Grecian games, instituted in early times in honour of Apollo, the conqueror of the Python. They were celebrated in the neighbourhood of Delphi (formerly called Pytho), in the Crissæan fields, which for this purpose contained a hippodrome or race-course; a stadium of 1000 feet in length; and a theatre, in which the musical contests took place. According to the popular mythological legend the Pythian Games were instituted by Apollo himself. They seem to have been originally only a musical contest, which consisted in singing a hymn to the accompaniment of the cithara, in praise of the Pythian god. Until about 586 B.C. they were under the management of the Delphians, and took place at the end of every eighth year; but after that date they were conducted by the Amphictyons, and were celebrated at the end of every fourth year, and prizes were added for flute-playing, athletic sports, and horse and chariot racing. Eventually contests in tragedy and other kinds of poetry, painting, sculpture, and historical narratives were introduced. At first the prizes were silver or gold, but afterwards they consisted of the laurel wreath and the symbolic palm-branch. The statues of the victors were, besides, erected in the Crissæan plain. They continued to be celebrated, it is believed, until the end of the fourth century of our era.

PYTHON, a genus of Serpents included in the family Boidæ. This family belongs to the sub-order of Colubrine Snakes, and to the Innocuous or Harmless section of that sub-order, in the members of which the upper jaw is provided with solid teeth only, fangs and a poison apparatus being absent. The Pythons belong exclusively to the Old World, and are very nearly related to the Boas, which occur in both hemispheres. They are serpents of enormous size, the typical genus Python, the species of which possess teeth in the intermaxillary bones, being found chiefly in India and in the islands of the Eastern Archipelago. These snakes may possess more than 400 vertebræ, and frequently attain a length of 30 or 40 feet, although these dimensions are sometimes greatly exceeded. The tail is eminently prehensile, and possesses two rows of plates on its under surface. The labial plates are deeply indented or pitted. A rudimentary pelvis and traces of hinder limbs exist in the Pythons, these structures terminating externally in a kind of hooked claw. The head is of triangular conformation, and exceeds the neck in thickness. The mouth is extremely large, and the gape very wide.

Although destitute of any venomous qualities, these snakes are greatly dreaded on account of their enormous strength, which is brought into requisition in the capture of their prey. Aided by their prehensile tails and rudimentary hinder limbs, the Pythons suspend themselves from the branches of trees, generally in the neighbourhood of water, and lie in wait ready to pounce upon animals which come to drink. The body is then wound round the victim, which is thus crushed into a shapeless mass by the powerful constricting folds of the snake. Stories of the huge bulk of which these serpents are able to swallow have been from time to time circulated, and although there may be good reason to doubt the capability of the largest python to swallow the body of an animal the size of a buffalo, there can nevertheless be no doubt that a goat or sheep can readily be disposed of. A variety of circumstances assist in the deglutition of prey of relatively large bulk by the Pythons. Thus, firstly, the body of the victim is primarily crushed into a shapeless pliant mass by the serpent itself. Then, secondly, its body is said to be smeared over by the glutinous or viscid saliva of the snake, so as to lubricate the mass and assist its deglutition. The teeth of these serpents are simply conical recurved structures, which, whilst useless for mastication, will tend to fix and retain the prey in the mouth, and prevent its egress during the movements of swallowing. And lastly, the mandibles or jaws may, through the loose and disjointed arrangement of the squamosal and quadrate bones, be very widely separated from the skull, so as to largely increase the size of the mouth from above downwards; whilst the halves of the lower jaw being but loosely connected by elastic ligaments, the cavity of the mouth can thus be greatly enlarged from side to side also. The throat is also exceedingly distensible, and from a consideration of the foregoing points it is easy to conceive how the bodies of even large animals may be slowly and gradually swallowed.

From observations on a female python (*Python bivittatus*) kept in France, eggs which were deposited on the 5th May, 1841, were hatched after fifty-six days of incubation, the young being mostly free from the eggs on the 3d July, whilst the last appeared on the 7th of that month. Only eight out of fifteen eggs, however, came to maturity. The mother took no nourishment during the entire period of incubation, but drank water on the twentieth day, and first ate on the 3d of July. The temperature of the mother's body while incubating rose to 73° Fahr., the temperature of the cage being about 50° only. The young drank water on coming from the shell, but did not eat until after they had cast or exuviated their first skin, an event which occurred between the tenth and fourteenth day of their existence. A female python of the species *P. sabæ* deposited eggs in the reptile house of the London Zoological Society in January, 1862, and during the incubatory period, when, as is the fashion of these snakes, the body of the female is coiled up around the eggs, the heat of the python's body was found to be from 6° to 20° greater than the temperature of the male, which was contained within the same cage.

The genus Python contains various species, the best known of which are the Royal Python (*Python regius*), the West African Python (*P. sebæ*), and the Reticulated Python (*P. reticulatus*). A South African species, described by Dr. Smith, is known under the designation of *Python Natalensis*. Fossil remains of a snake allied to the Pythons and Boa-constrictors, and which attained a length of about 12 feet, occur in the London clay of Sheppey (Lower Eocene). This form is named the *Palæophis toliapicus*, and the nearly-allied *P. typhæus* of the (Middle) Eocene beds of Bracklesham must have attained a length of nearly 20 feet.

PYX (Greek, *puxis*, a box).—1. The caskets in which the ladies of ancient times kept their jewelry. They were made of gold, silver, ivory, mother-of-pearl, tortoise-shell, &c., and were often finely ornamented with sculpture. 2. The sacred vessel used in the Catholic Church to contain the host. In ancient times it sometimes had the form of a dove, and was suspended above the altar. It was, however, generally of a rectangular shape, and frequently made of gold or silver, or of a baser metal plated with these. They

are now cylindrical, cup or bell shaped, with a cross-surmounted cover of the same material. They are frequently delicately chased and inlaid.

PYX, TRIAL OF THE, the official mode of ascertaining by weight and assay if the gold and silver coins issued from the Mint are of the standard weight and fineness. The trial takes its name from the Mint pyxes or strong boxes, two in number, one for gold and one for silver coins, and which contain trial plates or standard pieces having the exact percentages of alloy to render them sterling gold and silver, also other pieces of the exact weights of the several denominations of coins. The investigation takes place by a jury of goldsmiths summoned by the lord-chancellor. A few coins are taken from each day's melting, wrapped in paper, and put into one or other of the boxes. From time to time some of these are tested by the Mint authorities themselves for their own guidance and satisfaction; but the official trial takes place less frequently. For these a definite number of pieces are taken from each box, and after being each carefully weighed, are cast into ingots; these ingots are tested with rigorous accuracy to test if the metal correspond with the sterling pieces. If the coins are found to be correct within the small 'remedy' (see COINAGE) or margin of error allowed to the Mint-master, the test is accepted as conclusive, and the authorities of the Mint relieved from all responsibility. By 33 and 34 Vict. cap. x. (1870) the trial of the pyx is ordered to be held once a year, and the queen in council is empowered to issue orders as to the mode of holding it. The place where the meeting to make the test is held is generally Goldsmiths' Hall; and the trial pieces and standard weights are now transferred from the custody of the Exchequer to that of the Board of Trade.

Q.

Q, the seventeenth letter in the English alphabet, and one of the mutes. The ancient Latins had not this letter, but wrote *oblicus*, *locuntur*, not *obliquus*, *loquuntur;* and after it was introduced among the Romans, it was considered by some, not as a letter, but a character expressing two letters; hence some wrote *qis*, *qæret*, *qid*, while others preferred *cuis*, *cuæret*, *cuid*. The Greeks had not the letter. The Latin *q* is probably borrowed from the Phœnician and Hebrew ק (*koph*). It may be considered as a superfluous character; and in French and Spanish, which have no *k*, it has been retained in the alphabet only to express this sound. In the articles on the letters *G*, *H*, and *K* we have touched upon the near affinity of the aspirate and guttural sounds. The sound of *qu* is that of the guttural *k*, with the consonant *w* having either its English or German sound. *Qu*, *k*, *w*, or *v* are interchangeable sounds, as may be seen by comparing the Sanskrit *kas*, the Latin *quis*, the English *who*, and the German *was* together. That the sound became changed in Latin itself is evident by the derivation of *inquilinus* from *colere*, *coctio* and *coculum* from *coquere*. Q, as a Roman numeral, signified 500; with a dash over it, 500,000. Q, as an abbreviation, stands for *quæstor*, *quartus*, *quinquennalis*, *que* (as in the famous *S. P. Q. R.*, *senatus populusque Romanus*, the Roman senate and people), *quod*, &c.; *Q. TP.*, for *quo tempore* (in which time); *QVIR.*, for *quirinalia; QR.*, *quæstor reipublicæ*, quæstor of the republic, &c.

QUADI, a Teutonic tribe whose ancient territory was on the Danube, extending to the Theiss on the east and to the Carpathian Mountains on the north. They leagued themselves with their powerful neighbours the Marcomanni, and waged destructive wars with the Romans, particularly under Marcus Aurelius. They cease to be heard of in the fifth century, having probably migrated farther west with the Suevi.

QUADRAGESIMA, a Latin word signifying fortieth, and used to denote the forty days of fast (Lent) preceding Easter. Quadragesima Sunday is the first Sunday in Lent. See LENT.

QUADRANT, an instrument which used to be employed by astronomers in determining altitudes. It consisted of a brass limb, the quarter of the circumference of a circle, divided into 90°. Glasses attached to a straight rod, or in better instruments a telescope, enabled a heavenly body to be seen. The plane of the quadrant and the plane of motion of the telescope coincided with the meridian. The angle which the line of sight of the telescope made with a vertical line at the place of observation was measured on the quadrantal limb. The zero of measurement, or the reading of a vertical line on the limb, was carefully determined in the fixed instruments; in movable instruments a plumb-line was used to mark the zero during an observation. The difficulty of constructing an accurate instrument, and of correcting observations, led to the introduction of limbs which are complete circumferences of circles, so that at present the quadrant is not in use. The movable quadrant used to be employed at sea, but its place is now supplied by the sextant (which see).

QUADRANT ELECTROMETER, an instrument constructed by Sir William Thomson to measure with great accuracy small charges of electricity. It is of very great importance to telegraphic engineers and experimental physicists. See ELECTROMETER.

QUADRATE BONE. The bone developed in Reptiles and Birds, by means of which the lower jaw is articulated or joined to the skull. The lower jaw of these forms is thus not articulated directly or of itself to the skull, as in Mammals; and in Reptiles and Birds each half of the lower jaw is composed of a number of distinct pieces, converting it into a bone of compound nature. In Mammals, on the contrary, the lower jaw consists simply of two halves which are united together at the symphysis in front. The *os quadratum* or *quadrate bone*, which thus forms a characteristic structure of Birds and Reptiles, corresponds in Mammals to one of the little bones or *auditory ossicles* of the internal ear, named the *malleus*. See EAR.

QUADRATIC EQUATIONS. See EQUATION.

QUADRATURE. In astronomy the moon or a planet is said to be in quadrature when its longitude differs from that of the sun by 90°.

QUADRILLE, a dance of French origin, but now popular in most civilized countries of the globe, and which consists generally of five consecutive figures or dance movements, danced by four sets of couples, each forming the side of a square. It was originally danced by four couples; hence probably its name.

QUADRILLE, a game at cards, played, as its name implies, by four persons. It is played with a

pack of forty cards, the eight, nine, and ten of each suit being thrown aside. The deal is made by distributing the cards to each player three at a time for two rounds, and four for one round, commencing with the *right* hand player—the elder hand. It is best simply to cut between the deals without shuffling. The rank and order of the cards *when trumps* are as follows: 1st, Ace of spades, which, whatever be the trump suit, is always ranked as the best trump card, and is called *spadille;* 2d, that which would be the lowest card if the suit were not trumps (the seven if red and the two if black); this is called *manille;* 3d, ace of clubs, which, whatever be the trump suit, always ranks as the third best card, and is called *basto;* 4th, *ponto*, the ace of trumps, if the suit is red, if black there can be no ponto. After this, if the suit is red, come king, queen, knave, two, three, four, five, six (lowest); if black, king, queen, knave, seven, six, five, four, three (lowest). For suits *not trumps* the rank and order are: Red suits, king, queen, knave, ace, two, three, four, five, six, seven (lowest); black suits, king, queen, knave, seven, six, five, four, three, two (lowest). It will thus be seen that the red suits have one trump more than the black, the former having twelve and the latter only eleven. The three best trump cards, namely, spadille, manille, and basto, are called *matadores*, or shortly *mats*, and have the privilege that the holder is not bound to follow suit with them when trumps are laid, except when the card laid is a superior mat, which forces a lower one if there is no other trump in the hand. The cards being dealt and examined, the elder hand, if he finds his hand weak, may *pass*, that is, decline to lead; the second player may do the same, and so on all round; in this case the elder hand must lead, choosing which suit shall be trumps (which, of course, will be that in which he finds he is strongest), and cards are laid and taken as in ordinary card games. He may, however, risk standing alone, in which case he at once commences the game by naming trumps and playing a card; in this case he has to take six tricks before he counts game; if he succeeds he obtains the whole of the winnings, but if he fails he pays the whole of the losses. He may open the game in a different way by 'asking leave' (to have a partner), which is done by naming his trump suit and calling for his partner, the player who holds the king of any suit, not trumps, which he chooses to name. The player who holds this card then knows that he is the partner chosen, but must not reveal this fact except through his play. The other two players of course know they are opponents, and regulate their play accordingly. The player who holds the king must play it when his turn arrives. The player who asks leave is called *l'hombre* (or in English *ombre*), and he and his 'friend' (partner) win the game if they take six tricks, the gains being divided, and if they do not succeed in this they divide the losses. When six tricks are taken by either party the game may be continued if the winner or winners should choose to undertake all the ten tricks, which is called vole. If it is undertaken and not obtained the parties are subject to forfeits.

This game is complicated by a number of conditions which often modify the ordinary mode of playing. Quadrille was very popular and fashionable in England about the beginning of the century, but is now almost forgotten. *L'hombre*, the game celebrated by Pope in his Rape of the Lock, is essentially the same game, but played by three persons instead of four.

QUADRIVIUM (Latin, *quatuor*, four, and *via*, way), the name given by the schoolmen of the middle ages to the four mathematical branches of study, arithmetic, music, geometry, and astronomy, in contradistinction to the Trivium, which consisted of the three remaining branches taught in the mediæval schools, and which consisted of grammar, rhetoric, and dialectics, the whole comprehending what was called the seven liberal arts.

QUADRUMANA ('four-handed'), the name applied by Cuvier to denote the order of Mammalia represented by the Lemurs, Monkeys, and Apes, from the fact that these forms agree in possessing the *hallux* or great toe, constructed so as to be capable of opposing the other digits of the feet, instead of being placed parallel with the other toes, and adapted for supporting the foot on the ground. This conversion of the feet into 'hand-like' organs as it were, presented to Cuvier's mind so different and remarkable a structure from the disposition of the feet and toes of man, that he separated man as a sole and single genus to represent the distinct and opposing order of *Bimana* or 'two-handed' Mammalia. As mentioned in the article MAMMALIA, the classification of the highest Mammals has varied very considerably at various periods of scientific history. The *Primates* of Linnæus thus included in one great division not only man and all Quadrumana, but also the Cheiroptera or Bats; whilst in more recent systems of arrangement the term Primates is applied to indicate the highest order of Mammals, represented by man, Apes, and Lemurs, but excluding the Bats. This latter arrangement receives countenance from a consideration of the purely anatomical or *structural* relations existing between man and the Apes. And in modern zoology the Primates are commonly subdivided into two great groups as follows; this classification, if we omit the first family (*Hominidæ*), including man (and representing the order Bimana of other arrangements), representing succinctly the various divisions of the great order Quadrumana.

ORDER—PRIMATES.

Sub-order I. — ANTHROPOIDEA.

Family I.—HOMINIDÆ (=BIMANA), ...			Ex. *Homo*—Man.	
Family II.—SIMIADÆ, includes..	Sub-family 1. *Simiinæ* (*Anthropidæ*, or 'Man-like Apes' of some arrangements),	Genera	ex. Troglodytes,	Gorilla. Chimpanzee.
			ex. Simia,	Orangs.
			ex. Hylobates,	Gibbons.
	Sub-family 2. *Semnopithecinæ*	Genera	ex. Semnopithecus,	Entellus Monkey.
			ex. Colobus.	
	Sub-family 3. *Cynopithecinæ*	Genera	Cercopithecus,	Guenons.
			Macacus,	Macaque Monkeys.
			Cynocephalus,	Baboons and Mandrills.
Family III.—CEBIDÆ.....	Sub-family 1. *Cebinæ*	Genera	Ateles,	Spider Monkeys.
			Cebus,	Sapajous. Capuchins.
	Sub-family 2. *Mycetinæ*.....	Genus	Mycetes,	Howling Monkeys.
	Sub-family 3. *Pithecinæ*	Genera	Pithecia,	Sakis.
			Brachyurus,	
	Sub-family 4. *Nyctipithecinæ*.....	Genera	Callithrix,	Squirrel Monkeys.
			Chrysothrix,	
			Nyctipithecus,	
	Sub-family 5. *Hapalinæ*	Genus	Hapale,	Marmosets.

Sub-order II.—LEMUROIDEA (Lower Apes).

Family IV.—LEMURIDÆ	Sub-family 1. *Indrisinæ*	Genus	Indris,	Indris.
	Sub-family 2. *Lemurinæ*	Genera	Lemur, Hapalemur, Lepilemur,	True Lemurs.
	Sub-family 3. *Nycticebinæ*	Genera	Nycticebus, Loris, Perodicticus, Arctocebus,	Loris and Slow Lemurs.
	Sub-family 4. *Galagininæ*	Genera	Cheirogaleus, Galago,	Galagos.
Family V.—TARSIDÆ		Genus: Tarsius—Tarsiers.		
Family VI.—CHEIROMYIDÆ		Genus: Cheiromys—Aye-Aye of Madagascar.		

As limited to the Apes, Monkeys, and Lemurs, the characters of the order Quadrumana consist in the separation of the hallux or great toe from the other toes, and in its power of being opposed to the other toes, so as to convert the foot into a prehensile hand. The pollex or thumb may be wanting (as in *Colobus*), or very short (as in *Semnopithecus*); but when developed the thumb is also opposable to the other digits of the hand, and the animals thus become truly *quadrumanous* or 'four-handed.' The collar-bones are fully developed. The teats number two, the mammary-glands being *pectoral* in position, that is, placed on the breast. The placenta (which see) is deciduate and discoidal. The prehensile structure of the great toes is present even in Quadrumana (as, for example, the Baboons), which are purely terrestrial in habits, and which walk on all fours. The hand thus throughout all the Quadrumana is the prehensile organ, whilst the feet, however prehensile they may be, are also used for locomotion. The term quadrumana is therefore to be strictly used in accordance with the idea of what constitutes the definition of the word 'foot.' Thus if Owen's definition of a 'foot,' that it is 'an extremity in which the hallux forms the fulcrum in standing or walking,' is accepted, then man alone can be said to possess a pair of feet, since the feet of apes do not fall within this definition. Anatomically, the feet of apes agree more closely with man's feet than with his hands; and the hands of apes similarly resemble man's hands more nearly than his feet. So that the name 'Quadrumana,' four-handed, viewed with reference to the structure and function of the limbs, is erroneous, since both man and apes possess but two hands and two feet. It might, therefore, be more correct to regard the Quadrumana as Mammals provided with four well-developed limbs, the digits of which possess nails. These limbs may serve for climbing or for walking, and possess the hallux and generally the pollex opposable to the other digits. Teeth of three kinds, incisors, canines, and molars are developed, and are adapted for an herbivorous or insectivorous dietary. The body is covered with hair. The incisor teeth are generally present to the number of four, and the true molars to the number of six in each jaw.

As mentioned in the articles LEMURS, MAMMALIA, MAN, MONKEYS, &c. (which see), the Quadrumana may be arranged through the form of the nostrils and through their geographical distribution into three very distinct groups, according to Owen's system of classification. The *Strepsirhina* possess curved nostrils, and the second digit of the hind-limb has a claw. These forms are represented by the Lemurs, and by the Aye-aye, and are chiefly found in Madagascar, in Western Africa, and the Eastern Archipelago. The families *Lemuridæ*, *Tarsidæ*, and *Cheiromyidæ* represent this group. The *Platyrhina* or broad-nosed monkeys do not possess opposable thumbs, and generally have prehensile tails. These forms, represented by the family *Cebidæ*, are confined to America. The *Catarhina*, or Old World Monkeys, have oblique nostrils. The thumb is present, save in one instance—*Colobus*, and is always opposable. The tail is not prehensile, and may be absent. The Anthropoid Apes and other members of the family *Simiadæ* represent this last group. See also article MAN, &c.

QUADRUPED, a name popularly applied to those higher vertebrate animals which possess four developed limbs. This name, in fact, is popularly, but not scientifically synonymous with the term *Mammalia* (which see), the highest class of Vertebrata, provided with a hairy body-covering; warm blood; non-nucleated red blood corpuscles; and two occipital condyles. As, however, certain Mammals do not possess four limbs, but (as seen in the Whales, Dugongs, &c.) have only the fore-limbs developed, the name 'quadruped' is inapplicable to the class as a whole; and Man himself, although possessing four limbs, would not, even in a popular sense, be termed 'quadrupedal,' but 'bipedal.' The name, whilst therefore used in a popular manner to indicate familiar members of the class Mammalia, has no value or significance in a scientific or technical aspect. Certain lower Vertebrata, as, for example, Lizards, Crocodiles, Frogs, &c., might, so far as the strict etymology of the term is concerned, be also termed 'quadrupedal' animals.

QUADRUPLE AND QUINTUPLE ALLIANCE. The natural but undue influence which European states have mutually exercised upon each other has at times produced alliances more complicated than any which history elsewhere records, and which could be produced only by a combination of various interests. Alliances of this nature indicate the existence of powerful interests and counter-interests, to trace which to their origin is one of the chief purposes of history. The first quadruple alliance, so called from the number of the contracting parties, was the alliance which was concluded October 28, 1666, between the States-General (Holland), Denmark, the Duke of Brunswick-Luneburg, and the Elector of Brandenburg. The second was concluded at London, August 2, 1718, between Great Britain, France, and Austria, and was called quadruple because acceded to by Holland, February 16, 1719. The object of this league was to force Spain to consent to the Peace of Utrecht. It continued to be so called even after the Duke of Savoy and Spain had joined the alliance. The quadruple alliance of Austria, Russia, Great Britain, and Prussia, at Chaumont, March 1, 1814, originated from their coalition, which had effected the dissolution of the French Empire. After effecting its object it became the basis of the European political system which prevailed with little effectual opposition until 1830, having been confirmed by the Congress of Vienna, the Holy Alliance, and the Congress of Aix-la-Chapelle, in October and November, 1818, when the alliance became, in a certain respect, quintuple, as France joined the union professedly for the maintenance of peace in Europe. England joined the three other powers for the overthrow of Napoleon; but when the alliance became obviously directed against the national independence which had been originally its professed object, and religious sophistry was blended

with political to deceive the people, and the right of armed interference was boldly pronounced, and in several instances carried into effect, England naturally separated more and more from the other powers in consequence of its constitutional system, until at length Canning proclaimed the principle of non-intervention.

QUÆSTOR, the title given to two classes of magistrates of ancient Rome, the *quæstores parricidii* and the *quæstores classici*. The former had their origin in the time of the kings, and at first were appointed only at critical times, but after the establishment of the republic they were elected annually by the curies, on presentation of the consuls. They disappear from history in 366 B.C., as their functions were transferred to the Triumviri capitales. They were two in number, and it was their duty to conduct the prosecutions of persons accused of murder or any other capital offence, and to carry the sentence into execution.—The *quæstores classici*, usually called quæstors simply, were intrusted with the charge of the public treasury. The office seems to have been first instituted by Valerius Publicola, and they derived the epithet of *classici* doubtless from their being elected by the centuries. The office could at first be held only by patricians until 421 B.C., when the number, which had formerly been two, was doubled, and plebeians became eligible. Their duties consisted in making the necessary payments from the public treasury and receiving the public revenue, keeping a correct account of both in their tabulæ publicæ; they registered and exacted all fines, provided proper accommodation for foreign ambassadors and for such personages as were connected with the republic by ties of public hospitality; and took charge of the funerals and monuments of illustrious men who were interred at the public expense. The number was further increased to eight after the outbreak of the first Punic war, and a quæstor accompanied each consul at the head of an army. At first they had only to superintend the sale of the booty, but we find that they subsequently had the charge of the funds of the army, becoming in fact its paymasters. The two quæstors who resided at Rome were distinguished by the epithet *urbani*. As province after province was added to the Roman territory the number of quæstors was again increased, till under Sulla it reached twenty, and in the time of Julius Cæsar forty. Any person holding the office of quæstor had a right to a seat in the senate, unless excluded by the next censors.

QUAGGA (*Equus Quagga*), a species of the Horse genus, nearly allied to the more familiar Zebras, and found on the flat steppes or plains of Southern Africa. The Quagga is striped like the Zebra, but does not possess bands on the limbs. The colour is a dark or blackish-brown on the head, neck, and shoulders, the back and hind quarters being of a lighter brown, whilst the croup is of a russet gray. The under parts of the body are white, the upper parts of the legs and tail being marked by whitish bars. The Quagga is of smaller size than the Zebra, and in general conformation bears a closer resemblance to the Horse than the latter form. The ears are short, the head being relatively small. The tail is tufted. These animals appear to be gregarious in habits; the herds which inhabit the Caffrarian plains numbering each several hundreds of individuals. The herds of Quaggas are said to mingle indiscriminately with the Zebra herds. The Quaggas are active, nimble, and elegant in their movements. Their food appears to consist of grasses and Mimosa shrubs. They are tamed without difficulty, but domestication appears to alter their disposition and to render them dull and less active in habits. The Dutch colonists were said to be in the habit of keeping quaggas along with their cattle; and the quaggas defended the cattle from the attack of hyænas and other Carnivora, by trampling on the invaders and otherwise injuring them. The name 'quagga' is derived from the cry of the animal, which may most nearly be expressed by the word *Coua-ag*. The Bushmen and Kaffirs esteem the flesh of the Quagga as good palatable food, and these animals are on the same account unremittingly pursued by the lion. It will breed with the common horse; and a mixed race of this kind, possessing great beauty of form, and retaining in a great degree the characteristic markings of the quagga, existed in England some years since. The quagga has received a variety of names from authors; thus Pennant terms it the *quacha*, and Masson the *opeagha*. It should be remarked that Edwards has mistaken it for the female zebra. The Dauw, Peetsi, or Burchell's Zebra (*E. Burchelli*), appears to stand intermediately between the Quagga and Zebra. See also ZEBRA.

QUAIL (*Coturnix*), a genus of Rasorial birds, included in the family of the Perdicinæ or Partridges (which see). The quails resemble the latter birds in general form, but want the red eyebrow or space above and behind the eyes seen in the Partridges; whilst the bill is naked at its base, of slender shape, convex superiorly, and curved towards its tip. The tarsi are destitute of spurs. The tail is short. The wings are rounded, the first quill-feather being of equal length with the rest. The true quails are inhabitants of the Eastern Hemisphere and Australia exclusively—the American Quail, to be presently mentioned, belonging to a different genus from the common members of the group. The true quail enjoys a very wide geographical distribution. It thus occurs in North Africa, India, and China. It is found in every European country, and also in the south of Siberia, either as an annual visitor, or permanent resident. In Italy, Spain, and Portugal these birds thus appear to be permanent residents, large numbers in addition arriving in these countries in spring from North Africa and the south. Large quantities of quails are killed during this annual northward flight on the Mediterranean shores. In Britain the quails are not so abundantly represented as in France and on other portions of the Continent. The London market is supplied chiefly from France. In Britain these birds arrive early in May, and depart southwards in October. The males arrive first, and make known their presence by a thrice-repeated whistle. They may sometimes be lured and captured by the skilful imitation of the note of the female.

The Common or European Quail (*Coturnix dactylisonans*) attains an average length of about 8 inches. The feathers of the head are black, edged with a rusty brown. The hinder part of the neck and crown of the head are divided by a long pale-yellow line; the breast is of yellowish-red, spotted with black; the scapulars and feathers of the back are marked with a pale yellow line in their middle, and with ferruginous and blackish bars on their sides. The males largely exceed the females in number; and the song-notes of the sexes are quite distinct. These birds are alleged to be polygamous in habits, but this statement must be regarded as doubtful. The males assist the females in the care and upbringing of the young. The flesh is more juicy and delicate than that of the partridge. The nest is little else than a hole scratched in the ground. From six to twelve, or even fourteen eggs, of an oily green colour, are deposited; the larger number prevailing on the Continent, whilst in Britain six or eight are the usual numbers contained in a 'bevy' of quails. These

birds have also been noted on account of their pugnacious proclivities, and 'quail-fights' were indulged in as amusements by the ancient Greeks and Romans, just as combats of this nature afford amusement to the modern Chinese, and in some parts of modern Italy. The fighting quails are generally armed with artificial 'spurs,' after the fashion of fighting cocks. The food consists of grains and seeds, insects and worms; but for the table quails are principally fed on hemp-seed. (Pl. CXLVI.–CXLVII. fig. 11.)

The quails have been seen in Galilee by Hasselquist, and disputes have arisen regarding the zoological position of the quail of the Israelites; Hasselquist maintaining its identity with a species of Tetrao or Grouse, which he called *Tetrao Israelitarum*, whilst Colonel Sykes regards the scriptural quail as simply the modern and common quail just described.

Other species of true quails, distinguished by differences in the tongue and cæca, are described under the names of *Coturnix textilis*, *C. erythrorynchа*, *C. Pentah*, and *C. Argoondah*. The last-mentioned species is the Rock Quail of Dukkun or Deccan, and which is distinguished by the presence of numerous narrow transverse black bars on the breast. The young of this species want these bars, and also vary greatly in the markings of the back-plumage. The flesh of the Rock Quail is white; and by the natives of its districts this species is used for quail-fights.

The Virginian, Maryland, or American Quail or Partridge (*Ortyx Virginianus*), as it is variously termed, is included in the sub-family Odontophorinæ, together with another species known as the Californian Quail (*O.* or *Lophortyx Californicus*), and distinguished by the possession of a crest of curved feathers borne on the top of the head. The Virginian Quail possesses a short, highly arched bill, and large naked nostrils. The tarsus is smooth, the lateral toes of unequal size, and the tail is of moderate length. No spurs or crest exists. This bird is about 9 inches long and 14 in extent, usually weighing from 7 to 8 oz. The bill is black; a line over the eye, down the neck and whole chin being pure white, bordered by a band of black, which descends and forms a crescent on the throat; the eye is dark hazel; crown, neck, and upper part of the breast, red brown; sides of the neck spotted with white and black on a reddish brown ground; back, scapulars, and lesser coverts, red brown, mixed with ash, and minutely marked with black; wings plain and dusky; lower part of the breast and belly whitish, marked with black arrow heads; tail ash, spotted with reddish brown. The American Quail is common throughout North America, and extends in its distribution as far south as Honduras. The American Quail appears to differ from its migratory neighbours of the old world in being locally distributed; a fact well known to American sportsmen, who are in the habit of turning out pairs of these birds, when an unusually severe winter has destroyed the coveys in the neighbourhood. The female constructs her nest in May, and lays about fifteen or twenty eggs, which are perfectly white. Wilson is of opinion that the common idea, that quails occasionally lay in each other's nests, is correct. The food of the quail is composed of grain, seeds, insects, &c., buckwheat and Indian-corn being the favourite articles. The flesh is very white and tender, and is unequalled in delicacy by any other member of its order in America.

The Andalusian Quail (*Turnix tachydromus*) belongs to the sub-family *Turnicinæ*, and represents the only member of that group found in Europe. It is a native of both European and African shores of the Mediterranean, and appears to be of migratory habits. The bill is nearly straight, and of moderate length, the tip of the upper mandible overhanging the lower one. The nostrils are situated in a groove which runs beyond the middle of the bill. The tarsi are stout; the toes elongated and free at their bases; wings short; and the tail is hidden by the dorsal feathers. The food consists of seeds and insects; and these birds are said to be polygamous in habits.

QUAKERS, or FRIENDS, a society of Christians which took its rise in England about the middle of the seventeenth century. George Fox, a native of Drayton, in Leicestershire, was the first minister whose preaching was instrumental in convincing the people of those religious views which distinguish the society. He was born in the year 1624, and commenced his ministerial labours in 1647, being then in the twenty-third year of his age. The times in which he appeared were times of great social and religious agitation in England, the times of Cromwell and the Commonwealth. The principles of religious toleration were neither understood nor practised, and Fox immediately fell under persecution. His life was for a long time little better than a pilgrimage from prison to prison. But persecution, as usual, made him the object of public attention, and enlisted the sympathies of many in his cause. His missionary life extended over forty years, in the course of which he travelled repeatedly over all England and Scotland, besides visiting the Continent, and performing a missionary tour among the infant colonies of America. After making multitudes of converts he organized them into a church, which became one of the recognized sects of Christianity. Among the eminent ministers of the society we may notice George Fox, William Penn, Robert Barclay, George Whitehead, Stephen Crisp, Isaac Pennington, John Crook, Thomas Story, &c. The infant society was soon subjected to the rigours of a severe persecution, sometimes without the pretext of law, and at other times under cover of legal enactments, made either in Roman Catholic times or since the Reformation against nonconformists. The early Quakers were marked as a peculiar people by their testimonies against oaths, a paid ministry, tithes, and other ecclesiastical demands; their use of the singular pronouns when addressing only one person; their refusal to take off the hat as a compliment to men; and the faithful maintenance of their religious meetings. George Fox was one of the first who was imprisoned. In 1650 he was arraigned before two justices in Derbyshire, and on his exhorting those about him to tremble at the Word of God, one of the justices deridingly gave him and his friends the appellation of *Quakers*, which has since been generally applied to them by the world, though they themselves, as well as their successors, have adopted the name of *Friends*. The violence of persecution only tended to confirm the faith and strengthen the bond of union among the members of the rising society. Its ministers boldly preached their doctrines both publicly and privately, and were not deterred from their gospel labours by the severest punishments. The members, with one accord, united in strengthening each other's faith, encouraging all to continue steadfast to the religion they had espoused, and to endure with patience and even cheerfulness the loss of their estates, imprisonment, fines, whipping, banishment, and even death itself, rather than renounce their principles or violate their testimonies. The spirit of intolerance which caused the society so much suffering in England spread its baneful influence to America, and produced its natural results there also; but in neither country could it shake the constancy of the sufferers nor induce them to relinquish their conformity to what they regarded as duty. Their patient submission to the wrongs inflicted on them, the integrity and blame-

lessness of their lives, their probity, and the peaceable principles which they held, not only wrought conviction on the minds of many, and thus added to their numbers, but also had a favourable influence on those in authority, who saw that severity served rather to increase and establish the society than to arrest its progress. From these causes, as well as the diffusion of more liberal and enlightened views on the subject of religious liberty, acts were successively passed by the British Parliament, relieving Friends from the oppression under which they suffered, and tolerating their mode of worship, marriage, &c., and allowing them in a court of justice to make an affirmation in place of taking an oath in the usual way. The same liberal policy has been continued by the American government, so that at present they suffer no other molestation in that country than the occasional distraint of their property to satisfy demands made in lieu of military services, which they cannot conscientiously pay. In Great Britain they stand on the same footing as other people in respect of their liability to pay church-rates, and the mode of disputing the validity of the rate. The first Friends that went to America were two female ministers, who landed at Boston about the year 1656. Others occasionally visited that country at subsequent periods; and a number of persons having embraced the principles of the society, George Fox went over in 1672, and settled meetings of discipline for the care of the poor and the preservation of good order in the church. At this period there were meetings of Friends in most of the colonies along the sea-coast from Massachusetts as far south as the Carolinas. In 1682 William Penn arrived in the river Delaware with a large number of his brethren, who founded the city of Philadelphia, and settled themselves there or in the adjacent counties; and in each successive year their numbers were increased by new emigrants from the mother country, until they formed a large and respectable colony. Most of the ancient families in Philadelphia and its vicinity trace their origin to these settlers, and many of the noblest institutions of that city owe their rise to the liberality and benevolence of the Society of Friends. In the course of time it was found that the society had to a great extent lost its powerful influence as a proselytizing agent. The quietness of its worship, and even absolute silence of some of its meetings, deprived of the enlivening influence of sacred music, which has so often rendered invaluable service to the Christian church in all ages, made the Quaker assemblies unattractive to the masses and even to the young of their own community. The want of a distinct clerical order to think, write, and speak for them, and consequently the want of an extensive denominational literature, has checked the propagation of their church. Another cause has also operated in the same direction. Fox made his converts chiefly among the rural population; they were spread almost all over England; their property was in land and real estate, or such personal effects as were not likely to escape the notice of the tax-gatherers, and were easily subjected to assessment and distraint. The Quaker was bound on principle to resist the payment of tithes, and did so; vexation and loss were his constant portion. In the lapse of two centuries this produced a marked effect on the sect. It drove them into the cities, compelling them to invest their capital in different ways, and so wrought a change in their habits and mode of life. Numbers of them, owing to their frugality and prudence, acquired enormous wealth, with which came influence and social position. They became the associates and rivals of nobles and statesmen; they found themselves sitting side by side with the dignitaries of the church, who had seats in the House of Lords, and participated in national legislation. This was certainly a great change since the days when a hireling priesthood was an abomination, and the churches of the Establishment were derided as steeple-houses. Desertions from their ranks became numerous, and what was wholly unanticipated, the deserters went over to the once obnoxious Episcopal Church. Great wealth and recognized position operated likewise against the discipline of the body. Originally this discipline had been exceedingly stringent; their dwellings were subjected to a domiciliary visitation, and offenders were made to feel at once and emphatically that they had violated rule and forfeited the good opinion of their brethren. Those living in splendid mansions must be endued with an eminent gift of Christian meekness to be able to receive such a visit with becoming humility and submission, and those who administer such an act of discipline must have an assurance quite as extraordinary in order to do it with emphasis and effect. The consequence of this change of position has been a decline of the ancient discipline, and a relaxation of the watchfulness which the Friends once thought themselves bound to maintain over each other. About the year 1827 this peaceful sect which had existed so long without creed or confession began to be distracted by dogmatic debate. About that time Elias Hicks, a native of the state of New York, a man of uncommon depth and strength of mind, as well as force of character, great natural eloquence, and unswerving rectitude of life, created a schism in the society by promulgating opinions denying the miraculous conception, divinity, and atonement of Christ, and also the authenticity and divine authority of the Scriptures. About half the sect in America followed Hicks, and have since been known as the Hicksite Friends; their opinions are repudiated by the rest of the sect, who may be looked upon as the Orthodox Friends. The schism created immense excitement in the body in Great Britain as well as in America, and a movement was begun in favour of a higher education, of a creed closely allied to that of the evangelical party, and of a relaxation in the formality of the society. This movement, which was headed by Joseph John Gurney, of Norwich, was strenuously opposed by a body of Quakers in America, and the result was a division among the Orthodox Friends themselves, and the origin of a new sect, known as Wilburites, from the name of their founder John Wilbur. This sect is noted for the strictness with which they adhere to the traditions and peculiarities of the society. Some slight indications of theological differences have also shown themselves among the English Quakers. The society, as a whole, is never supposed to have exceeded 200,000 members; the number at present is estimated at 120,000, about three-fourths of whom belong to the United States.

In attempting to give a view of their testimonies and doctrines, the limits necessarily prescribed in an encyclopædia forbid anything more than a brief sketch. The society, or rather what we have called the orthodox section of it, believes that, under the gospel dispensation, all wars and fightings are strictly forbidden; the positive injunction of Jesus Christ, 'Love your enemies, bless them that curse you, do good to them that hate you, and pray for them which despitefully use you and persecute you,' entirely precluding the indulgence of those malignant passions from which only such contests can arise. They also apprehend that the express command of our Lord and his apostle James, 'Swear not at all,' prohibits the Christian from the use of judicial as well as other oaths, and that in all things his word should be yea and nay, 'for whatsoever is more than this

cometh of evil. As Jesus Christ declared to his disciples, that without him they could do nothing, and as he alone is the Head and Governor of his church, the society believes that a special call and qualification from him, by the influences of his Spirit on the soul are necessary to constitute a true minister of the gospel; and that as he commanded his disciples 'Freely ye have received, freely give,' so the faithful minister of Christ cannot make merchandise of the gift received, nor decline the exercise of it because he may not be compensated by a pecuniary reward. Owing to their theory that the real ministry of the community is merely the organ by which 'the Spirit speaks to the churches,' women, of course, may participate in the office of public teaching, edifying speech being considered a sufficient authentication of a religious teacher. It being generally admitted that the baptism of water and a participation in the outward supper are but the signs of that essential baptism of the Holy Ghost which our Lord Jesus Christ instituted, and of the communion of saints to which he alludes when he declared to the apostle John in the Revelation, 'Behold, I stand at the door and knock; if any man hear my voice and open the door, I will come in and sup with him, and he with me;' and as this spiritual baptism and communion are not dependent on the outward rites—the society does not consider these as necessary, but presses on its members a submission to the effectual operation of the Holy Spirit, by which the obedient soul is brought to the living experience of the substance of which these ceremonies are but the external symbols. As early as 1727 they freely censured the traffic in slaves as a practice neither commendable nor allowed, and the efforts of the society had a great influence in bringing about their emancipation. As simplicity and gravity in dress and demeanour are consonant with the Christian character, the society recommends its members to observe plainness in their apparel and the furniture of their houses, an adherence to the use of the singular pronouns 'thee and thou,' when addressing only one person, and the disuse of the customary salutations and tokens of obeisance. Its conduct in these respects arises from the apprehensions that the contrary practices originated in the pride of the human heart, and have a tendency to foster that haughtiness and self-conceit which it is so much the business of the Christian to mortify and subdue. The Friends object to balls, gaming-places, horse-races, and theatres; to indulging in music, especially what is generally called sacred music, and denounce oratorios and performances of that nature as essentially a profanation; they object also to the reading of plays, romances, novels, and other pernicious books, and to the vain custom of wearing mourning and all extravagant expenses connected with the burial of the dead. They do not use the ordinary names of the days and the months, as they are derived from pagan sources, but designate them by their numbers. The doctrines of the society may be stated in a few words; in doing which it will be proper to observe that its members prefer the use of such terms as are to be found in the Holy Scriptures. They believe in God, the Father; in Jesus Christ, his beloved and only begotten Son; and in the Holy Ghost, Comforter or Spirit of Truth, one true and living God, blessed for ever. That these are the holy Three that bare record in heaven; to wit, the Father, the Word, and the Holy Ghost, and that these three are one. That in the fulness of time our Lord and Saviour Jesus Christ took flesh, was conceived by the Holy Ghost, and born of the Virgin Mary at Bethlehem in Judea; that he was crucified under Pontius Pilate, voluntarily surrendering himself to the ignominious death of the cross, and suffered for our sins, the just for the unjust, that he might bring us to God; thereby becoming the one, great, universal offering and atonement for all mankind. Hence 'he is the propitiation for our sins, and not for ours only, but for the sins of the whole world;' and as each individual submits to the power of the Holy Spirit, renewing and changing the heart, his past transgressions are freely forgiven and blotted out for Christ's sake, and he comes fully to partake of the benefits of that redemption which was purchased for us by the coming, and sufferings, and death of the adorable Son of God. In expressing themselves concerning this glorious display of the love of God to fallen man, they include a full belief in the deity and manhood of Jesus Christ; in his miraculous birth, holy life, mighty miracles, death, resurrection, and ascension into glory in the heavens, where he is at the right hand of God, as our Redeemer, Mediator, and Advocate with the Father, and whence he shall come to judge the world in righteousness at the great and final day of judgment. As the whole human race is naturally fallen, degenerate, and spiritually dead, of themselves utterly incapable of doing anything that will tend to their salvation, so the society believes that all have need, and are the objects of that redemption which is freely offered for their acceptance through Jesus Christ our Lord. That 'the grace of God, which bringeth salvation, hath appeared unto *all men;* teaching us, that, denying ungodliness and worldly lusts, we should live soberly, righteously, and godly in this present world;' and that obedience to its dictates is essentially necessary to enable us to persevere in the work of pure and undefiled religion, and finally to receive the end of our faith, even the salvation of our souls. That there shall be a resurrection, both of the just and the unjust, according to the declaration of our blessed Lord, 'The hour is coming, in the which all that are in the graves shall hear his voice, and shall come forth; they that have done good unto the resurrection of life, and they that have done evil unto the resurrection of damnation,'—and that, according to the testimony of the apostle Paul, 'It is sown a natural body, and raised a spiritual body.' Although Friends do not call the Holy Scriptures the Word of God, but apply this epithet exclusively to the Lord Jesus Christ, yet they believe that these sacred writings are the *words* of God, written by holy men, as they were moved by the Holy Ghost; that they are profitable for doctrine, for reproof, for correction, for instruction in righteousness, that the man of God may be perfect, thoroughly furnished unto all good works; and that they are able to make wise unto salvation through faith which is in Christ Jesus. They also hold them to be the most authentic and perfect declaration of Christian faith, and the only fit outward judge and standard in all religious controversies; and that whatever, either in doctrine or practice, any profess or do, though under pretence of the guidance of the Holy Spirit, if it be contrary to or inconsistent with the testimony of the Holy Scriptures, it is to be esteemed a delusion and error.

The society is governed by its own code of discipline, which is enacted and supported by meetings of four degrees for discipline—namely, preparative, monthly, quarterly, and yearly meetings. The preparative digest and prepare the business for the monthly meetings, in which the executive power is principally lodged, subject, however, to the revision and control of the quarterly meetings. These are usually composed of several monthly meetings, which are accountable to the quarterly, and over which it exercises its jurisdiction and care. The yearly meeting comprises a number of quarterly meetings, which are

subordinate and accountable to it, and subject to its supervision and direction. Its authority is paramount, and it possesses the sole power to make or amend the discipline. For further information see Sewell's and Gough's Histories of the Quakers, G. Fox's Journal, Barclay's Apology, Evan's Exposition, Gurney's Peculiarities, &c.

QUAKING GRASS (*Briza*), a genus of grasses belonging to the tribe Festucineæ. It is known by its broad, three-ribbed glumes and its great boat-shaped, cordate, blunt, broad, awnless, lower pales, both of which have a membranous border. The species are few, and are mostly confined to Europe. *Briza maxima*, a native of Southern Europe, has been long and generally cultivated as a garden annual on account of its large and handsome drooping spikelets. *Briza media* is the only species common in this country. It is a perennial plant, with tufted, fibrous roots; the stem never exceeds 18 inches in length, and is usually shorter; it bears at the base a number of dark-green leaves. The spikelets are ovate, arranged in a loose panicle, each containing about seven florets, the lowest of which are sometimes larger than the glumes. These spikelets have a purplish colour, and are suspended by very slender, wiry stalks, on which they swing freely, trembling at every breeze. It flowers in the end of June, and is ripe by the middle of July. It is of some small agricultural value. Horses, cows, and sheep will eat it, and it is well suited to poor soils, whether sandy or heavy; any attempt to enrich the soil with manure is fatal to this grass. It is found in Britain at altitudes of 1500 feet above sea-level. Another species, *Briza minor*, much smaller in all its parts, with many triangular spikelets, also occurs in this country, but it is very rare, and of no agricultural value.

QUANTIFICATION OF THE PREDICATE, in logic, the use of some word or words to indicate whether the predicate of a proposition is distributed or not, that is, whether or not all the objects of which the predicate may be asserted are also objects of which the subject may (in affirmative propositions) be asserted or (in negative propositions) denied. Thus, when we say, Some men are logicians, we do not know from the form of the proposition whether we may not apply the predicate logicians to any who are not men, but if we quantify the predicate and say, Some men are all logicians, we at once show that this application cannot be made. Ploucquet and Lambert in the last century suggested the quantification of the predicate, but Sir William Hamilton was the first to give notoriety to the doctrine by the importance that he attached to it. He considered it as involving a complete revolution in formal logic. The theory of the necessity for the quantification of the predicate in logical analysis is based on the view that every proposition is an equation between the subject and the predicate, although in negative propositions this equation consists only in the terms being equally exclusive of one another. On this view he contended that the number of propositional forms recognized by logicians should be increased from four to eight, which he designated and symbolized in the following manner:—

Affirmatives.

1. Toto-total = Afa.	Example—	All X's are all Y's.
2. Toto-partial = Afi.	"	All X's are some Y's.
3. Parti-total = Ifa.	"	Some X's are all Y's.
4. Parti-partial = Ifi.	"	Some X's are some Y's.

Negatives.

5. Toto-total = Ana.	Example—	Any X is not any Y.
6. Toto-partial = Ani.	"	Any X is not some Y.
7. Parti-total = Ina.	"	Some X is not any Y.
8. Parti-partial = Ini.	"	Some X is not some Y.

It will be seen that in the symbols used by Sir William Hamilton F indicates affirmation, N negation, A distribution, I indistribution, and the position of A and I on the right or left of the symbol of affirmation or negation shows whether it is the subject or predicate that is distributed or undistributed. Among the numerous changes in the theory of formal logic that Sir William Hamilton points out as inevitably following the adoption of a quantified predicate the most important are the reduction of the conversion of propositions from three species to one (see Logic—Conversion), the reduction of all the general laws of categorical syllogisms to a single canon, and the abrogation of all the special laws of syllogism—a manifestation that figure is an unessential variation in syllogistic form, and that the practice of reducing the syllogisms from the other figures to the first is consequently absurd, and a large increase of the number of legitimate moods. As to the first of these changes ensuing on the adoption of a quantified predicate it needs but the slightest consideration to see how it comes about, for if all propositions are reduced to equations between subject and predicate it is obviously a matter of indifference which term of the equation be placed first, whether we say, All men are some animals, or Some animals are all men. The single canon that Sir William Hamilton substitutes for all the general and special laws of the syllogism is the following:—What worse relation of subject and predicate subsists between either of two terms and a common third term, with which one at least is positively related; that relation subsists between the two terms themselves. With regard to this canon it requires to be explained that a partial relation of one term to another and a negative relation of one term to another are considered as respectively worse than a total and an affirmative relation. Thus, in a syllogism with premises of this nature, Some useful animals are all horses, Any horse is not any carnivorous animal, Sir William Hamilton would say that the subject of the first premise bears a partial and therefore a worse relation to the predicate which is the common third term with which the subject of the first and predicate of the second premise are compared than the predicate of the second premise does, and that in the second premise the predicate bears a negative and therefore worse relation to the subject; whence it would follow that the subject of the conclusion (which is the subject of the first premise) must bear to the predicate a partial relation, and the two terms of the conclusion a negative relation to one another, the conclusion being in the form, Some useful animals are not any carnivorous animals. The inessential nature of differences of figure which Sir William Hamilton says is shown at once by quantifying the predicate is an obvious corollary from the fact that any proposition with a quantified predicate can be stated indifferently with either term first. Finally, the increase of the number of moods is manifestly a necessary consequence of the increase of propositional forms.

This doctrine of the quantification of the predicate was attacked immediately after it had been enunciated by Sir William Hamilton, as it has often been attacked since; and it has never been generally adopted in the exposition of formal logic. The principal ground on which it is attacked is that it is based on a complete misunderstanding of the true nature of a proposition. A proposition, it is said, is in no sense an equation between two terms, but is a form of words asserting or denying that the subject possesses the attributes expressed by the predicate. It does not indicate anything about the whole number of objects to which the predicate may be applied, but merely whether certain attributes do or do not belong to the subject. Accordingly when any form of words does indicate anything about the whole number of objects to which the predicate may be applied it is in reality a compound of two propositions. Thus, the proposition, All equilateral

triangles are all equiangular triangles, is compounded of the two, All equilateral triangles are equiangular, and All equiangular triangles are equilateral; and the proposition, Some men are all logicians, of the two, Some men are logicians, and All logicians are men. Then with regard to negative propositions, in which the predicate is partial, the attempt to establish them as an independent class of propositions is more completely illusory than it is to make affirmative propositions with a total predicate a separate class. A formula such as, Any man is not some animal, is not a predication at all, inasmuch as it does not say whether the attributes expressed by the predicate belong or do not belong to the subject, and all the meaning that the formula has is due to the fact that it implicitly denies something of the predicate, that it is indeed a contorted and unobvious way of saying that Some animals are not men. With a parti-partial negative proposition such as, Some Europeans are not some men, the case is even worse. By no manipulation is it possible to derive any information whatever from this formula. The objection, then, to Sir William Hamilton's additions to affirmative propositions is that they express too much, and to his additions to negative propositions that they express too little. The latter objection is decidedly the more serious, and hence the class of propositions to which it applies are rejected even by some of those who admit the affirmative propositions of Sir William Hamilton into their system. For the toto-total affirmative proposition the plea is made that every definition is an example of it. If we define man as a rational animal we mean not only that all men are rational animals but that men are all the rational animals that exist. But it is questionable whether this is a correct account of a definition. When we define a word all that we assert is that the word and its definition mean the same thing, from which it necessarily follows that they must be applicable to the same objects. For the parti-total affirmative proposition again it is pleaded that it is the only adequate converse of the universal affirmative of ordinary logic. When we convert All logicians are men into Some men are logicians we really mean, it is asserted, that Some men are all logicians. But this also is questionable. It may be contended that when we obtain the proposition Some men are logicians by conversion from All logicians are men we mean by that only what we say, and although it is the case that this proposition, if reconverted, would only give Some logicians are men, that does not matter practically, for since it is already admitted that All logicians are men (otherwise Some men are logicians could not have been obtained by conversion from that proposition) there can be no occasion for reconverting in that form. A better case might be made out for these additional affirmative propositions of Sir William Hamilton if it could be shown that any practical advantage in logic could be derived from their adoption; but there is no proposition that can be made that cannot be dealt with under the present logical forms, and the simplification of the theory of logic that is said to result from their adoption is not apparent from the example we have given above of the application of the new theory to a particular case—not apparent, that is to say, if to simplify is to render more easily intelligible.

It would take up too much space to go into all the details of the working out of the Hamiltonian theory of the quantification of the predicate; we therefore refer the reader to the Essay on the New Analytic of Logical Forms, by T. S. Baynes; Appendix II., annexed to Sir William Hamilton's Discussions, and the Appendices to his Lectures on Logic; Spalding's article on Logic in the Encyclopædia Britannica (8th ed.); and Mill's Examination of Hamilton's Philosophy.

QUARANTINE, the period during which a ship, coming from a port suspected of contagion, or having a contagious sickness on board, is forbidden intercourse with the place where she arrives. The term is derived from the Italian *quarantina*, a space of forty days, because originally that was the fixed period for all ships under such circumstances. But the time of a ship's detention is now very various, according to the exigencies of the case. By the 6 Geo. IV. c. lxxviii., masters of vessels liable to quarantine are bound to hoist the yellow flag on meeting other vessels at sea, or being within 2 leagues of the United Kingdom; they must answer interrogatories made to ascertain the state of their ships; they must not conceal the fact of their having touched at an infected place; they must not refuse to convey their vessel to the place appointed for quarantine; they must not quit their vessels during the period of quarantine, nor allow any other person to quit them. Noncompliance with the terms of the act subjects the offender to heavy penalties. Persons arriving in any infected vessel, or going on board and quitting it before discharged from quarantine, are liable to six months' imprisonment and a penalty of £300.

QUARLES, Francis, an English poet, born in 1592, near Rumford in Essex, was educated at Cambridge, and entered at Lincoln's Inn. He was for some time cup-bearer to Elizabeth, queen of Bohemia, but in 1521 went to Dublin, where he became under-secretary to Archbishop Ussher. He was driven from Ireland, with the loss of his property, by the rebellion of 1641, and was appointed chronologer to the city of London. At the commencement of the civil wars he wrote a work entitled the Loyal Convert, which gave offence to the Parliament; and when he afterwards joined the king at Oxford his property was sequestrated, and his books and MSS. plundered. He was so much affected by his losses, that grief is supposed to have hastened his death in 1644. Of the works of Quarles, in prose and verse, the most celebrated is his Emblems, a set of designs in prints, illustrated by verses. A great part of them are borrowed from the Emblems of Hermanus Hugo, but the verses are his own, and in the midst of much false taste and conceit contain frequent bursts of fancy and strokes of pathos. His Enchiridion is a collection of brief essays and aphorisms, in vigorous and occasionally eloquent language.

QUARRY, an open excavation made for obtaining stone, such as granite, marble, sandstone, limestone, and slates; so called, according to most authorities, from the fact that the stones are usually squared (old French, *quarré*) for building purposes, though others derive the name from the Erse *carraig*, a stone. At a very early period the sandstone rocks in the mountains of Silsileh, stretching along the banks of the Nile, were extensively quarried by the Egyptians, as material for the walls of their temples; the obelisks and statues which adorned those temples are formed of granite hewn from the quarries in the islands of Philæ and Elephantine, and particularly from the immense excavations in the mountain terraces near Syene. The Greeks obtained the materials of their finest temples and sculpture from the quarries of Mount Pentelicus, near Athens, and the islands of the Archipelago; in Greece and in Asia Minor an abundance of a greenish-white stone was dug from the earth for the ordinary purposes of architecture. Ancient Rome, as we learn from Vitruvius, was chiefly built of the calcareous stone obtained from the Travertine quarries; when the city was rebuilt after its destruction by fire in Nero's reign, the houses were constructed of the Alban and Gabian stone. For sculptured work the red stone from the quarries near the Lake of Bolsena was generally used.

The Carrara quarries, on the north-west slope of the Apennines, have long been famous for the fine white marble which they yield, and which is so extensively used for statuary. In the British Isles is found abundance of every kind of stone which can be used with advantage in architecture. Granite is obtained from the quarries of Cornwall, Aberdeen, and Wicklow; sandstone from those in the vicinity of Edinburgh, Glasgow, and Newcastle; limestone from the Kingston quarries in the Isle of Portland, Swanwich, in the Isle of Purbeck, and those in the neighbourhood of Bath; slates from the quarries of Argyleshire and North Wales; and marble from those of Derby, Devon, Kilkenny, and Galway.

The first operation in quarrying is the removal of the head of vegetable mould by the spade; the beds immediately beneath, which generally consist of stone of an inferior quality, are broken up by blasting (which see) or otherwise; the stones for important building purposes are usually found at a good distance below the surface. In the case of unstratified rocks, such as granite, whinstone, &c., stones are most frequently detached from the mass by blasting, a process by which much valuable stone is wasted, and a different method is employed whenever it is found possible. This is frequently the case with some stratified rocks, such as sandstone, from which blocks are separated by hand-tools alone. Small holes a few inches asunder are cut along a certain length of rock, into which steel wedges are inserted. These are driven in by heavy hammers until the stratum is cut through. The large blocks necessary for monumental purposes are obtained generally in this way. Before they leave the quarry they are usually reduced as nearly as possible to a rectangular form, the irregular parts are knocked off by a tool called a kevel, flat at one end and pointed at the other. Powerful cranes are employed for lifting or turning the heavier blocks. Where the water from the workings cannot be drawn off by syphons a steam engine and set of pumps are absolutely necessary in a quarry of any extent.

Quarries belong to the owner of the lands in which they are situated, and no person can work a quarry or remove the materials, unless he derives his right from the owner by lease or other legal title.

QUART, an English measure of capacity, being the fourth part of a gallon, or 8 gills. The ordinary quart bottle, however, is made to contain only from 5 to 6 gills.

QUARTAN AGUE. See AGUE.

QUARTER, the name of two English measures, one of weight and the other of capacity. The first is the fourth part of a hundred-weight, or 28 lbs. The second contains 8 bushels of 4 pecks. It is uncertain whether it is the fourth part of some long since disused measure, or whether the word is connected with a division of land known by the same name.

QUARTER, in heraldry, is applied to the parts or members of the first division of a coat that is quartered, or divided into four quarters. See HERALDRY.

QUARTER, that part of a ship's side which lies towards the stern, or which is comprehended between the aft-most end of the main chains and the sides of the stern, where it is terminated by the quarter-pieces.—*On the quarter*, implies the position of an object seen between aft and abeam.

QUARTER-DAYS, the days which begin the four quarters of the year: namely, the 25th of March, or Lady-day; the 24th of June, or Midsummer-day; the 29th of September, or Michaelmas-day; and the 25th of December, or Christmas-day. In England and Ireland it is usually contracted between landlord and tenant that rent should be paid, and that houses may be entered or left on these days. If no arrangement of this kind has been come to rent can only be claimed once a year. In Scotland there are two legal term days, Whitsunday (15th May) and Martinmas (11th November), on which, if no contrary agreement is made, rents are legally due. There are also two conventional terms, Candlemas (2d February) and Lammas (1st August), on which rents are frequently paid.

QUARTER-DECK, the upper deck of a vessel extending from the main-mast to the poop, or when there is no poop, from the mainmast to the stern. On ships of the royal navy the quarter-deck is used as a parade by the officers, and when the captain wishes to address the crew, or confer a mark of distinction, the men are summoned aft on the quarter-deck.

QUARTERING, in heraldry, is dividing a coat into four or more quarters or quarterings, by parting, couping, &c., that is, by perpendicular and horizontal lines, &c. See HERALDRY.

QUARTER-MASTER, in the army, an officer who attends to the quarters for the soldiers, their provisions, fuel, forage, &c. There is a quarter-master on the staff of each regiment, in which he holds the relative rank of lieutenant. The office is almost always given to an experienced old sergeant, who, if he serves thirty years in all, including ten as quarter-master, may retire with the honorary rank of captain. His pay is from 8*s.* to 11*s.* 6*d.* a day in the cavalry, and from 6*s.* 6*d.* to 10*s.* a day in the infantry, according to length of service.

QUARTER-MASTER, in the navy, is a petty officer, who, besides having charge of the stowage of ballast and provisions, coiling of ropes, &c., attends to the steering of the ship. He is appointed by the captain, and receives from £36, 10*s.* to £41 a year.

QUARTERMASTER-GENERAL, a staff officer of high rank in the army. His department is charged with all orders relating to the marching, embarking, disembarking, billeting, quartering, and cantoning of troops, encampments and camp equipage. Attached to every brigade is a deputy-assistant quartermaster-general, who receives over £173 a year, besides his ordinary pay; the quartermaster-general, who is attached to a whole army under a commander-in-chief, and who is always a general officer, receives about £692 a year in addition to his regimental pay. There is a permanent quartermaster-general having an office at the Horse Guards, and who has, besides his pay as a general officer, a yearly allowance of about £1384. It is his duty to superintend all the movements of the army, to organize expeditions, camps of instruction, and so on.

QUARTERMASTER-SERGEANT, is a non-commissioned officer who acts as assistant to the quarter-master. In the artillery his daily pay amounts to 4*s.* 2*d.*, in the cavalry 3*s.* 10*d.*, and 3*s.* 6*d.* in the infantry.

QUARTER-SESSIONS, in England, a tribunal held by two or more justices of the peace (one of whom must be of the quorum), in every county and division of county once every quarter of a year. Under the 1 Will. IV. cap. lxx., these sessions in the several counties, ridings, and divisions are required to be held in the first week after the 28th of December, in the first week after the 31st of March, in the first week after the 24th of June, and in the first week after the 11th of October; called otherwise the Epiphany, Easter, Trinity, and Michaelmas sessions. But by a later statute the justices may direct the Easter sessions to be held any time between the 7th of March and the 22d of April, so as not to interfere with the spring assizes. The jurisdiction of these courts, originally confined to matters touching the

breach of the peace only, has been gradually extended to the smaller misdemeanours and felonies, but with many exceptions; there is also an extensive jurisdiction in matters relating to the settlement of the poor, highways, conviction of vagrants, bastardy, &c., in most of which cases an appeal lies to the Court of Queen's Bench. The judges of quarter-sessions in the counties are all unpaid; they generally choose a chairman from among themselves to preside, an office of great honour and considerable responsibility. In boroughs quarter-sessions are now held by the recorders, who are barristers, who are appointed by the home secretary, and receive a small salary out of the borough fund. In Middlesex barristers are appointed for the trial of prisoners, and have the title of assistant judges.

In Scotland there are also courts of quarter-sessions held by the justices of peace four times a year at the county towns. The times of meeting are the first Tuesdays of March, May, and August, and the last Tuesday of October. At these meetings the justices have the power of reviewing the sentences pronounced at the special and petty sessions, when the sentence is of a nature subject to review. Such cases as fall to be tried by the English courts of quarter-sessions, are in Scotland disposed of in the sheriff courts of the county.

QUARTER-STAFF, an old English weapon formed of a stout pole of heavy wood, about 6 feet long, loaded with iron at both ends. It was grasped by one hand in the middle, and by the other between the middle and the end. In the attack the latter hand shifted from one quarter of the staff to the other, giving the weapon a rapid circular motion, and great skill was often shown in dealing or warding off blows delivered with the loaded ends.

QUARTET, or QUARTETT (Italian, *quartetto*, diminutive of four), a musical composition for four instruments, generally stringed instruments (that is, two violins, one viola or tenor violin, and one violoncello); also a composition for four voices, with or without accompaniment. All the parts are *obbligati*, that is to say, each is indispensable to the just performance of the piece. In instrumental quartets Haydn opened a new path. Mozart, Beethoven, the two Rombergs, Spohr, Ries, Onslow, Feska followed.

QUARTZ, the name of a well-known mineral species, which surpasses all others in the extent of its distribution. It is also one of the most comprehensive in the varieties it embraces, which are especially numerous as respects colour, lustre, and fracture. Pure quartz or rock-crystal consists of anhydrous silica, SiO_2; it occurs in distinct crystals, or in crystalline aggregation.

The crystals of quartz are, for the most part, regular six-sided prisms, terminated at one or both of their extremities by six-sided pyramids, the faces of which correspond to the sides of the prism, and meet under an angle of 141° 40′. It sometimes happens that the prism intervening between the two pyramids is very short, or even extinct; in which case the form becomes the dodecahedron, with isosceles triangular faces. In the six-sided prism with pyramidal terminations, we often observe the solid angles, situated between the prism and the pyramid, replaced by rhomboidal planes. The alternate faces of the prism are striated horizontally. The primary form is a rhomboid of 94° 15′ and 85° 45′ parallel to whose planes cleavages may be obtained, as also to the planes of the dodecahedron, with isosceles triangular faces, which might also be regarded as the primary form of the species; but the former figure is preferred on account of its simplicity. Lustre vitreous, inclining in some varieties to resinous; colourless when pure, but often exhibiting various colours from admixture of metallic oxides; among the brightest colours are violet-blue, rose-red, clove-brown, and apple-green. Streak white; transparent, translucent, frequently opaque, but never, perhaps, unless occasioned by other minerals; hardness between feldspar and spinelle; specific gravity, 2·69. The crystals often present macles, and sometimes we observe larger crystals, apparently made up of innumerable smaller ones, all of which are so aggregated that their similar faces coincide as respects direction. Implanted globules, reniform and stalactitic shapes, are other modes of occurrence with compound varieties of this species. These have smooth, granulated, and drusy surfaces; composition (mechanical) columnar, often impalpable, and frequently a second time composed into granular or curved lamellar masses. The massive varieties present a granular or columnar, and often an impalpable composition, in which case the fracture becomes conchoidal and splintery. Sometimes a second composition produces indistinct granular or thick lamellar masses. Certain very thin columnar compositions, if cut *en cabuchon*, parallel to the fibres, show an opalescent light. We have pseudomorphous crystals, also, of this species, in the shape of cubes, octahedrons, and various other forms, derived from fluor, calcareous spar, gypsum, &c., besides which quartz occurs in globular and tuberose masses, formed in vesicular cavities, and also in plates and pebbles.

The principal varieties of quartz, which are known by distinct names, are the following: 1, *rock-crystal;* 2, *smoky quartz;* 3, *yellow quartz;* 4, *amethyst;* 5, *siderite* or *blue quartz;* 6, *rose quartz;* 7, *milky quartz;* 8, *irised quartz;* 9, *common quartz;* 10, *fat* (*greasy*) *quartz;* 11, *flint;* 12, *hornstone;* 13, *Lydian stone;* 14, *floatstone* (*swimming stone*); 15, *fibrous quartz;* 16, *radiating quartz;* 17, *chalcedony;* 18, *carnelian;* 19, *chrysoprase;* 20, *agate.* The name rock-crystal is applied to transparent and colourless crystals, and more particularly to those of a large size. Smoky quartz consists of those crystals and crystalline masses which are translucent and of a brown colour. Yellow quartz, sometimes called also *Bohemian* or *Scottish topaz*, is transparent, and of various shades of yellow.—Amethyst, also in crystals, and for the most part nearly transparent, is of every shade of violet. Siderite, or blue quartz, is never in regular crystals, but usually compact, and of an azure-blue colour. Rose quartz is confined to translucent massive varieties, of a delicate rose-red colour. Milky quartz is also massive, having an uneven fracture, is translucent, and of a milk-white colour. Irised quartz embraces such crystallized varieties as exhibit in patches, at or beneath the surface, the colours of the rainbow. Common quartz differs from milky quartz simply in being destitute of the milky whiteness of that variety, or in having an inferior degree of whiteness, and more of a vitreous lustre. Fat or greasy quartz differs from common quartz merely in lustre, which, instead of being vitreous, has the appearance of having been immersed in oil. Flint has a more compact texture than common quartz, is dull, only translucent on the edges, of a brownish colour, and breaks with a conchoidal fracture. Hornstone closely resembles flint, from which it can scarcely be distinguished except in its conchoidal fracture, which is much less distinct. When replacing the fibres of wood it is called *woodstone*. Lydian stone, sometimes called *flinty slate*, differs from flint chiefly in having a darker colour, less translucency, and a fracture somewhat slaty; when black it is often called *basanite*. Floatstone consists of a delicate tissue of minute crystals, visible only under a powerful magnifier. Owing to the cavities it contains it sometimes will float on water. Fibrous quartz consists of those varieties

which are in distinct, parallel concretions. Radiating quartz is like fibrous quartz, except that the fibres diverge from a common centre, and resemble the radii of a circle, instead of being parallel. Chalcedony includes those varieties of radiating quartz where the thickness of the individuals becomes so much diminished as to render them nearly or altogether impalpable; its masses generally offer a mammillary or stalactitical surface, and the lustre on freshly-broken surfaces is feeble. Carnelian differs from chalcedony merely in having a blood-red colour. Chrysoprase also resembles chalcedony in composition, excepting that the individuals of which it is made up appear to be grains instead of fibres; its colour is apple-green, from oxide of nickel. Agate implies the occurrence of two or more of the above varieties existing together in intimate union; or it may be applied to a single variety, provided it offers different colours in the same specimens.

Those substances which have formerly been included under quartz, and which are mixtures only of this mineral with other species, are the following: 1, *cat's eye;* 2, *avanturine;* 3, *prase;* 4, *plasma;* 5, *heliotrope;* 6, *iron-flint;* 7, *Compostella hyacinth;* 8, *jasper* (*red, brown, striped,* and *porcelain*); 9, *jasper agate;* 10, *Mocha stone;* 11, *Venus-hair agate.* Cat's eye consists of transparent quartz traversed by exceedingly delicate parallel fibres of asbestos; when cut *en cabuchon* it exhibits, as its position is altered with respect to the eye, a peculiar play of light upon its surface, resembling the changeability of light seen in the eye of a cat. Avanturine is quartz penetrated by small golden-coloured spangles of mica. Prase is quartz penetrated by green fibres of hornblende, which are often so small as to escape detection by the naked eye, and their presence is only discoverable from the green colour they impart. Plasma is a variety of chalcedony, coloured leek-green, and having yellow and white spots. Heliotrope is likewise a variety of chalcedony, but coloured by green earth, and occasionally dotted with minute portions of red jasper. Iron-flint consists of quartz, intermingled throughout with oxide of iron. The Compostella hyacinth is a red variety of iron-flint, in regular six-sided prisms, with pyramidal extremities, which occurs imbedded in gypsum. Jasper differs from the two last varieties in being massive, and in containing variable proportions of clay. Red and brown jasper simply allude to the colour of the compound. Striped jasper appears to contain a larger portion of clay, and is distinguished on account of its striped delineations. Porcelain jasper is regarded as silicious slate altered by heat, and is found in the vicinity of coal-mines. Those varieties which are found in rounded masses, and which, from the concentric layers of which they consist, appear to have been formed in open spaces, are called *Egyptian jasper.* Jasper agate consists of those varieties of jasper in which several colours are so arranged as to produce an agreeable effect. Mocha stone consists of agate containing appearances of vegetable filaments, which have been occasioned through the infiltration of iron and manganese through its crevices. Venus-hair agate consists of quartz traversed by delicate hair-shaped crystals of any kind. Quartz is infusible before the blowpipe. It is dissolved by soda easily, and with effervescence. Two pieces rubbed together emit an empyreumatic odour and a phosphorescent light. Crystals of quartz may be obtained from a solution of silica in hydrofluoric acid, or in potash diluted with water. The fluid from which crystals of this species are formed, in geodes and other natural cavities of rocks, has been observed to be chiefly water.

With respect to the distribution of quartz (which we have remarked above to be the most abundant mineral known), it may be said that common quartz enters into the regular mixture of various rocks, of granite, gneiss, mica slate, topaz rock, &c. In others it occurs in single crystals and in grains, as, for instance, in porphyry, and is frequently met with in the vesicular cavities of amygdaloidal rocks. In these last situations in particular are found the finest varieties of chalcedony, carnelian, of jasper and agate. Hornstone forms globules and irregular veins in compact limestone; and flint occurs in a similar manner, but disposed through vast beds of chalk. Quartz also occurs in rocks of which it does not form a regular ingredient; sometimes in masses that are open in their interior, and lined with crystals of enormous size. It also exists in beds by itself, as in quartz-rock, and some varieties of sandstone. Striped jasper and flinty slate form also particular beds. The varieties prase and chalcedony, as well as amethyst, are often found in beds of iron ore. River sand, and that of extensive plains, where it is sometimes so fine as to drift before the wind, are formed chiefly of quartz. Common quartz, and several other varieties, are spread all over the earth, but certain varieties are confined to a few localities. The finest and largest rock-crystals are found in the Alps of Salzburg, the Tyrol, Switzerland, Dauphiny, Piedmont, and Savoy; also in the Isle of Madagascar, Ceylon, and Brazil. Above 100 years ago a great cavity lined with these crystals was opened in Zinken, which afforded 1000 cwts. of rock-crystal, and at that early period sold for nearly £7000. One crystal weighed 8 cwts.; others from 4 to 5 cwts. The Alps furnish the handsomest specimens of smoky quartz. This variety has of late been brought in large crystals and crystalline masses from Nova Scotia. The yellow quartz comes from Brazil and Bohemia. A variety, intermediate between the smoky and the yellow, occurs at Cairngorm, in Scotland. Amethysts of various colours are brought from Brazil, but those of the finest colours come from Ceylon, India, and Persia. A variety intermediate between amethyst and smoky quartz is found in Siberia. Amethyst also abounds in Transylvania and Hungary. Few localities of this beautiful variety are known in North America. Nova Scotia affords it in limited quantity; and a spot near Bristol, in Rhode Island, deserves to be mentioned for the fine crystals it has produced. Rose quartz occurs at Rabenstein, in Bavaria, and in Siberia; but no locality produces in so great perfection as that at Paris, in Maine. Prase comes from the mining district of Schwartzenberg, in Saxony, and from Cumberland, in Rhode Island. Smalt-blue chalcedony, sometimes in pseudomorphous crystals, occurs at Tresztyan, in Transylvania; the stalactitic shapes are found in Iceland and the Faroe Islands in amygdaloid, at Huttenberg and Loben in Carinthia; also in Hungary, Scotland, and Cornwall. Carnelian is brought from Arabia, India, Surinam, and Siberia. Chrysoprase exists at Kosemutz in Silesia, and at Newfane in Vermont. At this last-mentioned locality are found small prismatic crystals of quartz, deeply tinged by oxide of nickel. Chalcedony and carnelian are occasionally found, constituting very handsome agates, near Deerfield in Massachusetts, and at Southbury in Connecticut; they are also brought from Nova Scotia—in each of which places they occur in trap. Plasma is found in Moravia and in Bavaria. Flint is common in England, France, Poland, and Spain. Hornstone is abundant in many countries. Flinty slate forms beds, and occurs in pebbles in Bohemia, Silesia, Saxony, the Western States of the United States, and in the Canadas. Fibrous quartz is found in the Hartz; cat's eye in Ceylon and the coast of Malabar; and avanturine at the Cape de Gat, in Spain. Heliotrope

was formerly brought from Ethiopia, but is now generally obtained from Bucharia, from Tartary, and Siberia. Iron-flint, or ferruginous quartz, is frequent in the ironstone veins of Saxony, Bohemia, Hungary, Transylvania, &c. The Compostella hyacinth occurs near Compostella, in Spain. Striped jasper is found in Siberia, at Grandtstein in Saxony, at Ivybridge in Devonshire; the brown Egyptian jasper comes from the banks of the Nile; the red variety from Baden, also from the town of Saugus, near Boston, in Massachusetts.

Several varieties of quartz are of important use in the arts and manufactures, and have long been employed for purposes of decoration and utility by mankind. The ancients regarded rock-crystal as petrified water; they esteemed it particularly for the fabrication of vases, especially when it could be procured in large pieces. Such were the two cups which Nero dashed to pieces when he received the news of the revolt which caused his ruin, one of which had cost him a sum equal to £675. At present it is esteemed not only for cups, urns, chandeliers, but for seals, spectacle-glasses, and optical instruments. Amethyst takes a fine polish, and is much employed in jewelry. Its colour, when dark blue, is well adapted to that of gold, in which metal it is always set. The ancients were much in the habit of engraving upon this variety of quartz. The rose quartz is cut into vases and cups, and when of a delicate colour, and free from flaws, is highly esteemed. The yellow quartz is one of the most frequent stones employed for watch seals, having almost entirely supplanted the carnelian, which was formerly so much in vogue; it is called *topaz* by the jewellers. Chalcedony receives a high polish, exhibiting a slight degree of unctuosity. The ancients have left us many beautiful specimens of this variety of quartz, wrought into cameos and cups. They obtained it from the region of the Nasamones, in Africa, and from the environs of Thebes, in Egypt. The Japanese cut an immense quantity of carnelian into the form of the fruit of the olive, which they perforate, to be worn as beads. The carnelians which are sold at Bombay are brought from the province of Guzerat, in India, and the finest pieces come from the Gulf of Cambay. Lapidaries distinguish two varieties of carnelian, namely, those having a pale colour with a tinge of yellow, and those of a lively and deep-red colour. The last are the most rare, and the most highly esteemed, also, on account of their beauty. The Japanese are said to possess the art of heightening the colour of the pale carnelians. What is called *white carnelian*, is simply chalcedony. The carnelian was much in vogue among the Romans; and the moderns possess numerous specimens of ancient workmanship in this stone. The sardonyx (an intermixture of chalcedony and carnelian, the colours fading gradually together, and not arranged in distinct lines) was also in high estimation, in early times, and still continues to be employed in jewelry. The onyx, or banded agate, which exhibits two, three, or more colours, disposed in parallel lines, constituted the most valuable material for the exercise of the glyptic art, as the workman was enabled to make use of the different colours to represent his subject in a natural manner; for example, white and red were devoted to the representation of human flesh, while black, green, yellow, &c., were appropriated to drapery and other objects. The onyx, as well as the heliotrope and agatized wood, are also cut into thin plates for various kinds of inlaid work. The most important applications of this species to useful purposes depend upon its being composed of silica. Quartz enters into the composition of glass, both white and coloured. In the manufacture of porcelain it is added in the state of an impalpable powder, and forms part of the paste; it is also used in other kinds of pottery. Quartz is used as a flux in the melting of several kinds of ores, particularly those of copper, and in other metallurgical processes. The use of flint in gun-locks is well known. Touchstone is a kind of bituminous quartz.

QUASSIA is the product of plants of the natural order Simarubaceæ; they are all intensely bitter, and are natives of tropical America, India, or Africa. *Quassia amara*, according to several authorities, is not the tree which yields the quassia chips of the druggists, these being obtained from *Picræna excelsa*, Lind. The wood of this tree is bitter and tonic, and sometimes used as a substitute for hops. The aqueous infusion of the bark gives, by proper treatment, small white, opaque prisms, which have an intensely bitter taste. This substance is called *quassin*, and probably has the composition $C_6H_{12}O_3$. Although large quantities of quassia wood were formerly exported from Surinam, an informant of Lindley's stated that he did not hear of a single shipment during ten years that he resided in that place. The bark of the root of *Simaruba amara* is sent to Europe for medicinal purposes. The timber of this tree is described as resembling white pine in quality and colour.

QUATERNIONS, the name given by Sir William Hamilton to a method of mathematical investigation discovered and developed by him. It is most important in its applications to physics, especially in crystallography, optics, kinematics, and electro-dynamics. This calculus is eminently simple and natural in its treatment of problems. (See Hamilton's Lectures and Elements; see also the treatises of Tait and Kelland and Tait.) The most striking peculiarity of the calculus is that multiplication is not generally commutative; that is, $q\,r$ is in general different from $r\,q$, r and q being quaternions. It may be said that quaternions includes all the successful attempts which have been made to represent the imaginary factor of algebra $\sqrt{-1}$. This factor indicates a change in direction, through one right angle, of a line, and we see that the expression $a + b\sqrt{-1}$ represents a point whose co-ordinates are a and b. Now Hamilton saw that to enable his calculus to deal with space indifferently in all directions he could not indicate any one direction in space by real numbers, and he uses imaginary expressions to indicate every direction; his method is therefore independent of any supposed directions in space, and takes its reference lines solely from the data of the problem to which it is applied. In fact, when using quaternions, we deal with geometrical lines as we deal with them in our thoughts, and hence the simplicity and directness of this method of investigation.

Any expression, as $\overline{AB}$, denoting a line in direction as well as in length, contains implicitly three numbers; and all lines parallel and equal to the first depend in the same way on the same three numbers. Hence all equal and parallel lines may be represented by a common symbol, and this symbol contains three distinct numbers. In this sense a line is called a *vector*, since by it we pass from one extremity A to the other B; it is, in fact, an instrument which carries A to B, and a vector is used to indicate a definite translation in space. We find that two vectors are compounded as two velocities or two forces are compounded in mechanics, and also that any vector may be resolved into three components, parallel respectively to any three given non-parallel vectors not in the same plane. Hamilton employs as lines of reference a series of three mutually perpendicular unit vectors, denoted by i, j, and k. What has just been

said with regard to vectors enables a great number of difficult geometrical problems to be solved readily; for instance, such problems as are given as exercises in modern geometry. When two vectors are parallel, their ratio is simply the ratio of their lengths; that is, one may be obtained from the other by the use of the instrument, an ordinary numerical multiplier. But consider the instrument which changes the vector O A into the vector O B; we shall find that O A must be subjected to four distinct operations before it can be changed into O B; an increase or diminution in length, and then the turning of it from its present direction to that of the line O B. To specify this turning process, mathematicians know that three numbers are required. Thus the ratio of two vectors, or the multiplier required to change one vector into another, in general depends upon four distinct numbers, whence the name quaternion. The order in which these two distinct operations is performed is immaterial. The stretching factor, or that which performs the first operation, is called the *tensor*, and the turning factor is called the *versor*. Here we have regarded a quaternion as the product of a tensor and a versor, but it may also be regarded as the sum of a numerical quantity and a vector; the numerical quantity is called a *scalar*. The proof of this property, as given by Tait, is very simple. Known properties of the tensors, versors, scalars, and vectors of products and quotients of vectors may be interpreted in a vast number of ways, and it is in this that we discover the great power of the calculus.

QUATRE-BRAS, a village of Belgium, in the province of South Brabant, 20 miles S.S.E. of Brussels, situated at the intersection of the main roads between Brussels and Charleroi, and from Nivelle to Namur. It is famous for the battle fought here (16th June, 1815) between the English under Wellington and the French under Ney. It was Napoleon's plan at the opening of the campaign of 1815 to fight the armies of the allies singly, as he felt himself unable to cope with their combined forces. At the head of an army of 129,000 men, supported by 350 guns, he made a rapid march into Belgium, crossing the Sambre almost before the allies were aware of his movements. His army was divided into three corps; the right wing, 48,000 strong, being under Grouchy; the centre, of 28,000 men, under the emperor himself; and the left wing, of 48,000, under Ney. The Prussians and English under Blücher and Wellington lay between the French and Brussels. With the right wing and centre of his army Napoleon furiously attacked the Prussians, who, after a severe struggle, retired upon Wavre (16th June). On the same day Ney attacked Wellington at Quatre Bras. The English, 32,000 strong, repulsed Ney, and maintained their position, though at a tremendous loss. The Duke of Brunswick fell in the action. The English general bearing of the retrograde movement of the Prussians fell back on the 17th on Waterloo, where the decisive battle was fought on the following day.

QUAVER. See MUSIC.

QUAY, a landing-place along a line of coast or a river bank, or round a harbour, and having posts and rings, frequently also cranes and store-houses, for the convenience of merchant ships. They are usually constructed of stone, but sometimes of wood and iron, or even of fascines. The last material is, however, far from being an economical one, as the maintenance of a quay of this construction is very expensive.

QUEBEC, a city in the Dominion of Canada, capital of the province of the same name, and third city in the Dominion in point of population, situated on a promontory near the confluence of the St. Lawrence and the St. Charles, terminating abruptly in Cape Diamond, which has a height of 333 feet, and on the low banks below the rocks along the margin of both streams. It is 400 miles from the mouth of the St. Lawrence, and 140 miles north-east of Montreal. It is divided into the upper and lower towns. The former, placed on the summit of the promontory, is strongly fortified; the citadel, occupying the highest elevation of the town, and hard upon the St. Lawrence, has an area of 40 acres; and the whole position is so strong by nature, and wherever in the least degree exposed has been so strengthened by formidable works erected on the most approved principles, that it is justly deemed all but impregnable. On the same plain with the upper town, to the west, lies the suburb of St. John, and to the south-west are the Plains of Abraham. The lower town lies under the cliffs, along the St. Lawrence and the St. Charles; and adjoining to it on the west, on a flat on the latter stream, lies the suburb of St. Roche. The towns are connected by three gates; and two gates, in addition, lead out from the upper town towards the Plains of Abraham. The streets of Quebec are mostly narrow, irregular, and frequently steep, excepting in the suburbs, which are modern, and built upon a more regular plan. The houses are principally of stone or brick, two or three stories high, though some wooden structures still exist; and their roofs, generally of a high pitch, imparting a quaint and antique appearance to the city, are mostly covered with tinned iron or with shingle. An abundant supply of water is obtained from Lake St. Charles, just above the Fall of Lorette, 9 miles distant. The lower town is the great seat of business. The banks of both rivers are lined with warehouses, and with wharfs jutting about 200 feet out into the stream, along which the largest vessels can lie. The basin of the river immediately below the town, where it is 2500 yards wide, affords excellent anchorage for ships of large tonnage. Opposite Cape Diamond the breadth of the river is only 1314 yards. The winter in Quebec is as severe as in the centre of Russia, and the summer is as warm as in the south of Italy. The mean temperature in winter is 10°, and in summer 68° Fahr. The great majority (more than five-sixths) of the inhabitants are Roman Catholics, chiefly French Canadians.

The principal buildings, in respect of architecture, are the parliament buildings, the Roman Catholic cathedral, the Protestant cathedral, the Scotch Free church. Other important structures and institutions are the Hôtel Dieu nunnery and hospital, founded in 1636; the Ursuline convent, an extensive establishment for the education of females, founded in 1641; three Roman Catholic colleges, namely, Laval University, with faculties of law, medicine, and arts; the Grand Seminary, and the Minor Seminary; Morrin College, Laval Normal and Model School, Quebec High School; the general and the marine hospitals, the lunatic asylum at Beaufort, the exchange, public library, museum of the literary and historical society, which possesses valuable records of the realm, and a large collection of historical manuscripts; the Advocates' Library, and the Board of Trade. On the Plains of Abraham a column 40 feet high has been erected to the memory of General Wolfe; and in the upper town a handsome obelisk, on a granite pedestal, of a total height of 65 feet, has been erected to the joint memory of both the commanders, Wolfe and Montcalm, who fell at the taking of Quebec.

Ship-building is the chief manufacturing industry of Quebec. There are also manufactures of iron-castings, machinery, steel, cutlery, nails, leather, musical instruments, paper, india-rubber goods, rope, tobacco, &c. Quebec is the chief seat of the Canadian winter trade in timber. As the rafts come down the

river they are collected into what are called *coves*, and secured by booms moored along the banks, the timber being partly afloat, partly aground, according to the rise or fall of the tides. These coves extend almost continuously along the left bank of the St. Lawrence for a distance of 6 miles above the town, and there at certain seasons may be seen a mass of logs of timber nearly 6 miles in length, and of a breadth varying from 150 to 200 yards. There are also extensive timber and deal-sawing establishments near the town, on the right bank of the St. Lawrence. The principal imports of Quebec are cotton, woollen, silk, and linen goods; iron, steel, and hardware; coals, spices, and salt. The principal exports besides timber are fish and fish-oil, ashes, grain, fruit, and hides. The total value of the imports in 1881–82 was £967,118; that of exports £1,604,305; and the total amount of duty collected amounted to £170,156. The total number of vessels registered belonging to Quebec in 1882 was 876 of 102,530 tons, of which 142 of 14,140 tons were steamers. Quebec returns three members to the House of Commons of the Dominion, and three to the provincial legislature.

Quebec was founded in 1608 by Champlain, geographer to the King of France, on the site of an Indian village called Stadacona. In 1629 it came into the hands of the English, but was restored in 1632 to the French. It was fortified in 1690. In that year the English attempted to reconquer it, but suffered a disastrous defeat, and it remained in the possession of the French till 1759, when it fell into the hands of the British, in consequence of Wolfe's famous victory on the plains of Abraham. At that time the population was estimated at 8000 to 9000. The only serious attempt made upon it since the British possession was formally ratified in 1763, was by the American revolutionists on Dec. 31, 1775, when Montgomery the American general lost his life in the attack. In May and June, 1845, it was visited with two calamitous fires, which destroyed about 1600 houses, including the entire suburb of St. Roche, and rendered nearly a third of the inhabitants of the city houseless. Pop. in 1881, 62,446.

QUEBEC, Province of. See Canada.

QUEDAH, or Keddah, a small state on the west coast of the Malay Peninsula, lying immediately to the north of Province Wellesley, and extending to the Talavise River, lat. 7° N. The name signifies an inclosure for catching elephants. It is a well-wooded and mountainous country. There are numerous rivers which are for the most part navigable. The climate is warm but healthy. The agricultural products are rice and pepper, but the chief wealth of the state consists in its ivory and tin. The capital is a town of the same name, with a population of 6000. The island of Lankava is dependent on Quedah, and is very populous and well cultivated.

QUEDLINBURG, a town in the Prussian government of Magdeburg, province of Saxony, situated at the foot of the Harz Mountains, 35 miles south-west of the town of Magdeburg. Besides churches it has a town-house, orphanage, four hospitals, and an institute for juvenile offenders. On an eminence above the town is an old castle, once the residence of the abbesses of Quedlinburg, who, as princesses of the empire, had a vote in the diet. One of them was the mistress of the King of Saxony, and mother of the celebrated Marshal Saxe. The manufactures of Quedlinburg are woollen goods, beet-root sugar, leather, chemicals, beer, iron and brass founding, &c. It has also numerous mills and distilleries. It has a trade in grain, cattle, ham, and excellent sausages. The poet Klopstock was born here. Pop. in 1880, 18,437.

QUEEN (Anglo-Saxon, *cwen*, a wife), the wife of a king. In Britain the queen is either *queen-consort* or merely wife of the reigning king, who is in general (unless where expressly exempted by law) upon the same footing with other subjects, being to all intents the king's subject, and not his equal; or *queen-regent*, regnant, or sovereign, who holds the crown in her own right, and has the same powers, prerogatives, and duties as if she had been a king (see Britain), and whose husband is a subject, and may be guilty of high treason against her; or *queen-dowager*, widow of the king, who enjoys most of the privileges which belonged to her as queen-consort. It is treason to compass or imagine the death of the queen-consort, and to violate or defile her person not only renders the person committing the act guilty of treason, but the queen herself, if consenting. If the queen be accused of treason she is (whether consort or dowager) tried by the House of Peers. Queen Caroline was proceeded against by a bill of pains and penalties. Before the law a queen-consort has a different position with reference to her husband from any other woman. Her civil rights and abilities are not merged in those of her husband, and she is in fact, in most respects, considered not as a *feme covert*, but as a *feme sole*. A queen-dowager enjoys most of the privileges that belonged to her as queen-consort; but it is not treason to compass or imagine her death or to violate her chastity, because no danger to the succession is thereby incurred. If she marries a subject she still retains her royal dignity, but no man can marry her without a special license from the crown, on pain of forfeiting his lands and goods. By act of Parliament 1 and 2 Vict. cap. ii., December 23, 1837, the queen has granted to her, in return for the surrender of the crown lands to Parliament, an annual allowance of £385,000 for the support of the royal household and dignity. (See Crown Lands and Civil List.) In Prussia, Sweden, Belgium, and France, the succession being confined to the male line, there can be no queen regnant. (See Salic Law.) In Spain and Portugal females are now admitted to the throne.

QUEEN ANNE'S BOUNTY, a fund applied to the increase of the incomes of the poorer clergy of the Church of England, and to aid incumbents in rebuilding parsonages by granting advances of money, in virtue of a royal charter confirmed by 2 and 3 Anne, cap. xi., by which the first-fruits (the whole income of an incumbency for the first year after a new appointment) and the tenths (a tenth of the annual income of every incumbency), which before the Reformation had been paid to the pope, but had been annexed to the crown by Henry VIII., were assigned to a corporation created by the act and intrusted with the duty of administering the fund for the purpose mentioned. The livings that were to benefit by the bounty were all those not exceeding £50 a year, and these were from that time exempted from the payment of the dues by which the fund is constituted. Various acts have since been passed regulating the management of this fund. The corporation that administers the fund has authority to make rules for its distribution. The principal rules that it has established are, that no sum over £200 is to be granted for the augmentation of any single living, and that the grants are to be made in the first instance to those livings not exceeding £10 a year, then to those not exceeding £20 a year, and so on as long as there are any livings under £50 a year. The sums allotted for the purpose of increasing the livings are laid out in land, which is annexed to the livings for ever. But when any private benefactor advances £200 for the augmentation of a particular living the corporation adds to that other £200, provided the living is not above £45 in yearly value.

QUEEN CHARLOTTE'S ISLANDS, a group of islands in the North Pacific Ocean, off the coast of the mainland of British Columbia, north of Vancouver's Island. It consists of two larger and several smaller islands. The northernmost of the two larger islands is called Graham Island and the southernmost Moresby Island. The greatest length of the two together is about 160 miles, and the greatest breadth (of the northern island) about 70 miles. The climate is excellent. The islands are covered with magnificent forests, and are rich in minerals. Gold-bearing quartz of rich quality has been found, and copper and iron ores and a fine vein of anthracite coal also exist. On the coast are numerous creeks suitable for harbours. Queen Charlotte's Islands were first seen by Captain Cook about 1770, and were taken possession of by Dixon in 1787 in name of the British crown. They were made a part of British Columbia on the formation of that colony in 1858.

QUEEN CHARLOTTE SOUND, a channel in the North Pacific Ocean, separating Vancouver's Island from the mainland of British America on the north, and forming the commencement of a long series of inlets continued along the north and east of that island. Cape Caution, its north-east limit, is in lat. 51° 12′ N.; lon. 127° 57′ 30″ W. The navigation is dangerous from the Virgin and Pearl Rocks, the prevalence of fogs, and the violence and irregularity of the tides.

QUEEN'S BENCH (or KING'S BENCH), COURT OF, a separate court formerly existing in England, which was considered as the most direct successor to the *aula regis* or great court established in the Norman period, and divided into several branches for the trial of different kinds of pleas. In this court, which is now a division of the High Court of Justice created by 36 and 37 Vict. cap. lxvi. (1873), the sovereign was, by a fiction, supposed to preside in person, and the writs are accordingly made returnable 'before the king [or queen], wherever he may be in England,' because the court formerly followed the king to different parts of the kingdom, and was once held, in the twenty-first year of Edward I., at Roxburgh in Scotland; but for many centuries its sittings have been held in Westminster Hall, and the king never presides at its sittings. Sir Edward Coke says if he were present still justice could be administered only by the justices in the same manner as when he is absent; and Sir William Blackstone says, when James II. sat there he was told by the justices that he must not give his opinion. The Queen's Bench consists of one chief-justice and five puisne justices. The three courts of Westminster Hall—King's Bench, Common Pleas, and Exchequer—at the time when they were constituted out of the *aula regis*, had jurisdiction of distinct kinds of actions, the King's Bench having cognizance of criminal suits, the Common Pleas of suits between party and party respecting land-titles and on contracts, and the Exchequer in matters of revenue. These courts have also a jurisdiction in respect to the person, and not resting wholly on the kind of action. Every one, for instance, has jurisdiction of suits in which its own attorneys or some other of its officers are parties, and through this right of jurisdiction in relation to the person the Queen's Bench has drawn to itself cognizance of actions of almost all descriptions in which the proceedings are at common law, except real actions; nor does this exception much abridge its jurisdiction, for title to lands in England is tried in personal suits between the parties to a real or supposed lease of the lands in dispute. This general jurisdiction was acquired upon the principle that no other court could bring before it a person imprisoned by the Queen's Bench; and in respect to every such person, therefore, suits must be brought against him in that court, or there would be a failure of justice as long as he should thus continue to be imprisoned. A defendant being accordingly once arrested and imprisoned, in an action brought before this court, might, while so in custody, be sued in any civil action in the same court. By taking one step farther the jurisdiction was made general in such actions, namely, by adopting the fiction that the defendant was imprisoned by the court. The great mass of the present business of this court which fills the reports of its proceedings is brought under its cognizance by this fiction. The department of the Queen's Bench that takes cognizance of criminal cases is called the crown side or crown office, and that which acts in civil causes the plea side. The Queen's Bench has also supervision of all the inferior courts of common law throughout the kingdom, from all which a writ of error lies to this court, and from any of which it may at its own pleasure remove any case by a writ of *certiorari*, as it may stop the progress of a case in any inferior court by a writ of *prohibition*. It may also punish magistrates and officers of justice for wilful and corrupt abuses of their authority; and in order to determine the title by which any person holds some civil office, franchise, or liberty, may, by a writ of *quo warranto*, demand of any claimant to such office or privilege by what authority he supports his claim. This species of supervision has in some cases been extended to other than civil and judicial officers, as in the case mentioned by Noy, where the court issued a *mandamus* to the Bishop of Exon to allow the sacred unction and baptismal oil to the people of a certain parish, to whom they had been denied by him. This power of supervision is frequently exercised by ordering officers of corporations to discharge the duties incumbent upon them. Another important writ issued by this court is that of *habeas corpus*, by which it protects the liberty of the subject. As a division of the High Court of Justice the Queen's Bench exercises the same functions as it did when it was an independent court. By the 34th section of the act above cited there are assigned to this division all causes and matters civil and criminal pending in the Court of Queen's Bench at the commencement of the act (November 2, 1874), and all causes and matters civil and criminal which would have been within the exclusive cognizance of the Court of Queen's Bench in the exercise of its original jurisdiction if the act had not passed. There was formerly an appeal from this court to the Exchequer Chamber, and thence to the House of Lords, by writ of error; but this is now abolished. See SUPREME COURT OF JUDICATURE.

QUEENS' COLLEGE, Cambridge, was founded in 1448 by Margaret of Anjou, queen of Henry VI., and again in 1465 by Elizabeth, queen of Edward IV. It consists of a president and thirteen foundation fellows. The latter retain their fellowships unconditionally for seven years from election; but no fellow can retain his fellowship for more than one year after his institution to a college living the net annual value of which is above £400. A fellow of the college who holds a professorship in the university or the office of public orator may retain his fellowship as long as he continues to hold such office; and fellows holding certain offices within the college have special privileges in respect of the tenure of their fellowships. A fixed proportion of the revenues of the college is paid to a scholarship fund, which is distributed by the governing body among the scholars. In 1883 the number of scholars was 22, and their stipends ranged from £30 to £70. Six of the scholarships are conferred after examination, and are open to all persons under nineteen years of age who

have not commenced residence in the university at the time of the examination. There are nine church livings in the gift of the college, and one in that of the president, who must nominate to it one of the eight senior divines. There are in addition four exhibitions named after their founders, and the president distributes £130 per annum in grants to deserving students of limited means. The college buildings are among the most interesting in the university, and include four courts of small size. The gallery of the president's lodge is 80 feet long and has three quaint oriel windows. In a tower in the Pump-court are the rooms inhabited by Erasmus (1506). John Fisher, Thomas Fuller, and Bp. Pearson were members of the college.

QUEEN'S COLLEGE, Oxford, was founded in 1340 by Robert Eglesfield, chaplain to Philippa, queen of Edward III., and it is from her that it gets its name. The subsequent foundations of John Michel, Sir Francis Bridgman, and Lady Margaret Hungerford were consolidated into one with that of Eglesfield in 1858; and the college, under statutes framed by the Oxford University Commissioners in 1882, now consists of a provost, from 14 to 16 fellows, about 25 scholars, and two Bible-clerks. The scholarships are of the annual value of £80, and are tenable for five years; candidates must be under nineteen years of age. The Bible-clerkships, which are also tenable for five years, are of the annual value of £80, and their holders occupy rooms rent-free. Six of the scholarships are called Eglesfield scholarships, and are to be awarded, in case suitable candidates offer themselves, to natives of Cumberland and Westmoreland. There is also a scholarship called the Jodrell scholarship, of the annual value of £90, and tenable for four years; and a considerable number of other exhibitions. The college presents to twenty-three church-livings.

QUEEN'S COLLEGES, Ireland. These colleges are three in number, situated at Belfast, Cork, and Galway, and were chartered in 1849 in pursuance of an act of Parliament passed in 1845 (8 and 9 Vict. cap. lxvi.), enabling the queen to endow new colleges for the advancement of learning in Ireland, and granting £100,000 out of the consolidated fund for establishing and furnishing the same. The colleges were opened in October, 1850. They are at present regulated by the charters of 1863. The constitution of each college is the same. The corporate body of each college consists of the president and professors, and the general government and administration are vested in a council consisting of the president and six members, elected by the professors from among themselves. The elective members of council hold office for three years, the two senior ones retiring every year, and a new election taking place to fill the vacancies. There is an appeal from the decisions of the council to the visitor, who is appointed by the crown by sign-manual. Every student attending any of the colleges must dwell with his parent or guardian, or some near relation, or in lodging-houses approved by the council of the college. Deans of residences are appointed, and are required, among other things, to make provision for securing to the students the means of due attendance upon such religious instruction and divine worship as may be approved by the parents and recognized by the college authorities; and students habitually neglecting divine worship and religious instruction are liable to expulsion. The session of the Queen's Colleges extends from October to June. In their first session the students in arts study English, Greek, Latin, a modern language, and mathematics. In the second session logic, natural history, and two of the following, viz.:—Greek (second course), Latin (second course), a modern language (second course), and mathematics (second course). In the third session they study the English language and literature; metaphysics, or history, or political economy; chemistry; zoology, or botany. Students who are preparing to compete for university honours are allowed to substitute any two courses of lectures specifically designed for honour candidates for two of the courses above set down for study in the third session. The number of students attending during the session of 1882–83 was 994.

Students of the Queen's Colleges in Ireland may obtain degrees in arts, medicine, and law from the Royal University of Ireland by observing the course of studies prescribed by that body, and passing the requisite examination. This university was founded in pursuance of the provisions of the University Education (Ireland) Act, 1879, and has now superseded the Queen's University in Ireland, it being provided that the graduates and students of the latter university shall have similar rank in the new university. The Royal University corporation consists of a chancellor, a senate, and graduates. The government is vested in a senate consisting of a chancellor, and senators (the latter not to exceed thirty-six in number), with power to grant all such degrees or other distinctions as can be conferred by any university of the United Kingdom, except in theology. The charter gives power to grant such degrees to all male and female students who shall have matriculated in the university, and passed the requisite examinations prescribed by the senate, and provides that no residence in any college, nor attendance at lectures, or any other course of instruction in the university, shall be obligatory on any candidate for a degree, other than a degree in medicine or surgery, the university in this respect resembling that of London. The act 44 and 45 Vict. cap. lii. provides for the payment of £20,000 a year out of the surplus funds of the Irish Church for the purposes of the university, which has its seat in Earlsfort Terrace, Dublin.

QUEEN'S COUNSEL, in England, barristers appointed counsel to the crown, and called within the bar. They have precedence over all other barristers except such as have patents of precedence entitling them to rank above all queen's counsel, or to rank with them in order of seniority. They are appointed by patent from the crown on the nomination of the lord-chancellor. They cannot be employed against the crown without special license, but this license is always granted (on payment of a fee) unless the crown itself desires to retain the counsel on the case with reference to which the application is made. In this respect they resemble the *advocati fisci* of the Romans, who, however, under the empire were still more restricted in their practice, not being allowed to serve at all in any case between subject and subject. By 13 and 14 Vict. cap. xxv. queen's counsel are enabled to act as judges of assize when named in the commission. It is the established etiquette of the profession that no queen's counsel conducts any case without the assistance of a junior counsel. The professional robes of queen's counsel are of silk instead of stuff like those of ordinary barristers, and hence the phrase 'to receive the silk gown,' or 'to take silk,' is often used in the sense of 'to be raised to the rank of queen's counsel.' The first to be appointed to the rank of queen's counsel was Sir Francis Bacon in 1590. Formerly queen's counsel received a small salary, but this is no longer the case.

QUEEN'S COUNTY, an inland county in Ireland, in the province of Leinster, bounded on the north-west and north by King's County, east by

Kildare and a detached portion of King's County, south-east by Carlow, south by Kilkenny, and south-west by Tipperary; area, 664 square miles, or 424,854 acres. The surface is generally flat, rising in the north-west into the Slieve-Bloom Mountains, whose highest summit, Ardesin, is 1734 feet above sea-level. In the south-east are the Dysart Hills, consisting chiefly of a series of isolated eminences. The first are composed principally of sandstone, and a part of the second of the anthracite coal-measures, which are extensively worked in the south. Iron, copper, and manganese are found, but not worked. Limestone abounds, and in a few places marble is obtained. The soil is fertile except where bogs occur, but these are pretty numerous towards the centre of the county. Principal rivers, the Barrow and Nore, both of which rise in the Slieve-Bloom Mountains. There is only one lake in the county, Lough Annagh, length about 1 mile. Agriculture is not generally in an improving state, drainage in particular being much wanted. The principal crops are oats, barley, potatoes, turnips, and mangel-wurzel, which in 1883 covered respectively 23,604; 19,747; 16,953; 12,572, and 2098 acres. The total area under crops in that year was 140,526 acres. The number of agricultural horses in that year was 8909; cattle 78,496; sheep, 70,530; and pigs, 33,834. Principal towns, Mountmellick, Maryborough, and Portarlington. Queen's County returns two members to Parliament. Pop. (1841), 153,930; (1881), 73,124.

QUEENSFERRY, two places in Scotland.—1 (*South*). A royal burgh and seaport town in the county of Linlithgow, 8 miles west by north of Edinburgh, on the south side of the Firth of Forth, at a point where the latter suddenly narrows to a width of about 2 miles, and almost as suddenly again expands to a breadth of nearly 4 miles. The ferry at this point was at one time the principal means of communication between Edinburgh and the north of Scotland. A railway bridge to span the Firth of Forth here was begun in the autumn of 1878. Pop. 1064.—2 (*North*). A village in the county of Fife, 6 miles S.S.E. of Dunfermline, on the north shore of the Firth of Forth, opposite South Queensferry. It is frequented for summer and sea-bathing quarters. Pop. 360.

QUEENSLAND, an Australian colony, established in 1859, north of New South Wales. The line which separates it from New South Wales begins on the coast at the river Tweed, in lat. 28° 10′ S.; follows this stream to its source, then strikes on the Dumaresque, and having reached on the Dumaresque the 29th parallel of latitude, the boundary line runs due west to the 141st meridian east of Greenwich, which is the limit of South Australia, then due north to lat. 26°, then due west, along the north end of South Australia, to 138° E., which parallel forms its western boundary north to the Gulf of Carpentaria. It thus forms the north-east portion of Australia, and has an area of about 668,224 square miles, or 427,663,360 acres, of which in 1882 about 274,000,000 belonging to the crown were leased. It is divided into twelve large districts, namely, Moreton (comprising East and West Moreton), Darling Downs, Burnett, Port Curtis, Maranoa, Leichhardt, Kennedy, Mitchell, Warrego, Gregory, Burke, and Cook. The districts in the south-east, where the population is mainly collected, are subdivided into smaller districts. Towards the west a large portion of the surface is dry and barren, but towards the east, and for a long stretch along the coast, boundless plains admirably adapted for sheep-walks, and lofty ranges of hills, generally well wooded and intersected by fertile valleys, form the prevailing features of the country. Along the coast, and among the numberless islands that skirt it, are tracts on which cotton of excellent quality and an almost unlimited quantity may be grown. The principal rivers are the Brisbane, the Burnett, the Pioneer, the Fitzroy, and the Burdekin flowing into the Pacific, and the Flinders and Mitchell into the Gulf of Carpentaria. Some of these streams are navigable for a considerable distance inland. The coast is indented with many noble bays, having capacious natural harbours, which have already been brought into practical use as the outlets for the produce of the adjacent districts. A large part of the surface consists of rich grassy downs well supplied with water. The climate is healthy, and the temperature comparatively equable. In 1881 the highest reading of the thermometer was 108° Fahr. in the shade, and the lowest 34°. Sheep-farming is the chief industry, but cattle thrive well also. In 1882 the number of sheep in the colony was 12,043,893, and of horned cattle 4,089,715. The soil and climate are well suited for the production of all the ordinary cereals, as well as maize, tobacco, coffee, sugar, cotton, and other plants. The only cereal crop grown to any considerable extent is maize, which in 1882 covered 46,480 acres, or about half the total area under cultivation. The next crop in point of importance is sugar. All kinds of semi-tropical and English fruits are abundantly grown. Gold, tin, and copper are the principal minerals, but coal and plumbago are also found in large quantities. The gold-fields cover an aggregate area of 7000 sq. miles; the stanniferous country is estimated to occupy an area of 225 sq. miles, and some parts are very rich in tin. The coal-measures cropped out on the surface over some 24,000 sq. miles. In the north pearl-fishing is now being actively carried on. The manufactures are unimportant. The principal manufactories are sugar-mills, steam saw-mills, soap-works, and distilleries. There is also a considerable number of cotton gins in the colony. At the end of 1882 there were 867 miles of railway open. There are two principal lines, one in the south proceeding west from Brisbane, with a branch to the southern frontier, and another in the north running west from Rockhampton. There were on Dec. 31, 1882, 6344 miles of telegraph line. The number of letters transmitted through the post-office in 1882 was 5,952,619, and of newspapers and book-packets 5,504,824. Education is free in the state schools, fees being abolished. There is no state church, each religious denomination being entirely self-supporting. The principal imports of the colony are linen and drapery, flour and bread, iron and steel, boots and shoes, tea, spirits, hardware, machinery, stationery, wine, &c.; and the principal exports, wool (in 1882, to the value of £1,329,019), gold (in 1882, to the value of £829,655), tin (value £269,994, in 1882), sugar (£152,108, in 1882), tallow, preserved and salted meats, cotton, wood, hides, and skins. The value of the total imports in 1882 was £6,318,463, and of the exports, £3,534,452. The total value of British home produce imported in 1882 was £2,013,045, and of the exports to the United Kingdom £1,341,974. The staple article of export to the United Kingdom is wool, the value of which in 1882 was £1,087,811; the next in value being tallow, £84,214; and preserved meat, £64,068. A duty of 5 per cent. is charged on imports of yarns, woven fabrics, manufactured leather, salted beef and pork, and paper and stationery; and duties at other rates on some other articles. The total tonnage of shipping entered and cleared at the ports of Queensland, exclusive of the coasting trade, in 1882, was 1,880,399. In 1882–83 the revenue of the colony was £2,383,859, and the expenditure £2,317,675; debt in 1883, £15,625,350.

The first settlement of Queensland took place in

1825, when the territory was used as a place of transportation for convicts, who continued to be sent there till 1839. In 1842 the country was opened to free settlers, and in December, 1859, it was organized as a separate colony. The government of the colony is vested in a governor, who is the queen's representative, and a Parliament of two houses, the legislative council and the legislative assembly. The council consists of thirty-nine members appointed by the crown for life, and the assembly of fifty-five members elected by the people for five years, and representing forty-two electoral districts. The first Parliament met in May, 1860. The capital of the colony is Brisbane. Population in 1881, 213,525, namely, 125,325 males, and 88,200 females.

QUEEN'S METAL. See BRITANNIA METAL.

QUEEN'S TOBACCO-PIPE, the name popularly given to a furnace in London, situated in the north-east corner of the tobacco warehouses belonging to the London docks. It is so called because it is used for burning all sorts of contraband articles that have been seized by the custom-house officers, but especially tobacco. Many kinds of tea are, however, excepted on account of the danger of a conflagration through the escape of the burning leaves at the chimney, which it is almost impossible to prevent. The ashes from the tobacco-pipe are purchased at a high price for manure by gardeners and landowners in the neighbourhood, and are also in great demand for soap-making and other chemical manufactures.

QUEENSTOWN, formerly Cove of Cork, a maritime town of Ireland, and an important naval station, in the county, and 9 miles south-west of Cork, on the south side of Great Island, which is situated in Cork harbour, and rises abruptly from the water's edge to a considerable elevation. The streets rise above one another, and present a very picturesque appearance; they are wide, clean, and well paved; and the houses in the principal streets are mostly large, of stone, and well built. It has a handsome Episcopal church, and a splendid Roman Catholic cathedral, estimated to cost £200,000, is in course of erection. Cove has little trade and no manufactures, being almost solely dependent on the military and naval establishments in its vicinity, and on the numerous visitors attracted by the singular beauty of the place, and by its delightful climate. In honour of her Majesty's visit to Cove in 1849, the name of the place was changed to Queenstown. Pop. (1881), 9755.

QUENTIN, ST., a town in France, in the department of Aisne, on a height above the Somme, 87 miles north-east of Paris. It is an ancient place, and from its position on the frontiers between France and the Low Countries figures much in history. In 1557 a battle was fought under its walls, in which the French were signally defeated by the Spaniards and a body of English auxiliaries, and the town was afterwards taken and sacked. In 1801 the fortifications were converted into a public walk. In October, 1870, the town was occupied by the Germans, who retained it till the 15th January, 1871, when they were driven out by the French, but only for four days, for it was recovered by them after a battle on the 19th of January. The town is well built, and has among its edifices a beautiful Gothic cathedral, a Gothic town-house, with a tower and an arcade, formed by eight pillared arches; a court-house, theatre, infirmary, and several hospitals. The staple manufactures are cotton and woollen goods; and the trade includes, in addition to these, corn, fruit, flax, sugar, and liquorice. The environs are covered with bleachfields. Pop. in 1881, 45,838.

QUÉRARD, JOSEPH MARIE, a French bibliographer, born at Rennes, December 25, 1791; died at Paris, December 3, 1865. From the age of ten he was connected with the book-trade. In 1817 he came to Paris, and afterwards travelled professionally over France, England, and Italy. From 1819–24 he was attached to a well-known firm in Vienna, and while employed there he prepared the first part of his great work La France littéraire, in which he gives a complete bibliography of France for the eighteenth and the beginning of the nineteenth century, comprising not merely notices of French writers, but also of all those foreign authors whose works had been reprinted or translated in France. The whole work was published in ten volumes between 1827 and 1842. In 1830 the author received from the minister Guizot an annual subvention of 1000 francs to enable him to continue the work. Among the other works of Quérard are La littérature française contemporaine, which was intended to complete the former, but of which Quérard himself prepared only the first two volumes (1839–44); Supercheries littéraires dévoilées (1845–56); Archives d'histoire littéraire, intended to form a monthly supplement to La France littéraire, but stopped for want of subscribers after two volumes had appeared (1855–56).

QUERCITRON, in dyeing, the internal bark of the *Quercus tinctoria*, a species of oak; it yields its colour, which is yellow, by infusion in water, and by the common mordants gives a permanent dye. By exhausting the bark with alcohol, removing tannic acid, and evaporating, a pale yellow crystalline body is obtained, called quercitrin, to which the formula $C_{23}H_{20}O_{17}$ has been given.

QUERÉTARO, one of the states of the Mexican Confederation, bounded on the north by the department of San Luis Potosi, on the west by Guanajuato, on the south-west by Mechoacan, on the south and east by Mexico, and on the north-east by Vera Cruz; area, 3207 square miles. It forms part of the central plateau of the Cordillera, presenting a very rugged surface, traversed by mountain spurs and lofty heights, sometimes bare and sometimes covered with forests. Its rivers are few, and almost all of insignificant dimensions. The most important vegetable product is grain, which is raised in large quantities; and together with cattle forms the chief wealth of the state. The minerals, once famous, are now comparatively unimportant, though numerous mines are still counted, mostly of silver. Manufactures have made considerable progress, and many woollen and cotton fabrics are woven from materials produced within the state; the latter from a species of cotton much used in the manufacture of blankets, shawls, and rebozos (a kind of mufflers or short cloaks). Leather, soap, and hardware are also manufactured. Querétaro entered the confederation in 1824. Pop. 203,290.

QUERÉTARO, a city in Mexico, capital of the department of the same name, on a plateau 6365 feet above sea-level, 110 miles north-west of Mexico, on the sides and summit of several converging hills. It consists of the city proper and suburbs, separated by a small stream, and presents an appearance at once imposing and picturesque. Among the public edifices particular notice is due to the principal church, a magnificent and richly-decorated structure, and containing a splendid altar of pure silver; and a noble aqueduct, about 2 miles long, spanning a plain, with arches 90 feet high, and by communicating with a tunnel in the opposite hills, bringing a copious supply of excellent water from a distance of 6 miles. Its manufactures, though greatly declined, include considerable quantities of woollen and cotton goods, horse covers, articles in leather, cigars, soap, paper, &c. Its trade, after suffering much from the unsettled state of the government, has begun to revive. The peace between Mexico and the United States was

ratified here by the Mexican Congress in 1848. Querétaro was the last town in which Maximilian of Austria took refuge (March 13, 1867). When the town fell into the hands of the republicans on the 15th of May following, Maximilian was made prisoner, and having been condemned to death by a council of war, was executed on the 15th of June. Pop. 27,560.

QUERN, a hand-mill for grinding corn, such as is or has been in general use among all nations that have not reached an advanced state of civilization. The word was in Anglo-Saxon *cwœorn*, in Old High German *querne* or *quern*, in the Mœso-Gothic of Ulphilas *quairn*, and is no doubt derived from the Anglo-Saxon *cyrran* (Old High German *queren*, modern German *kehren*), to turn, and hence connected with *churn*. The simplest and most primitive form of the quern is that in which a large stone with a cavity in the upper surface is used to contain the corn, which is pounded rather than ground with a small stone. The next form of the hand-mill is that which is so frequently mentioned in the Bible, and is often described in Jewish and other ancient writers. It consisted of two stones (the upper and the nether millstone) circular in their shape, and with the opposing surfaces carefully cut smooth. The lower stone was fastened into the ground or floor, while the upper was movable, and could be lifted off or turned round as occasion required. Further improvements were fastening a handle of wood or iron to the upper millstone, to enable it to be turned round with greater ease; making a hole in the middle of the upper stone to feed the mill, so as to dispense with the necessity of lifting the stone off; and cutting the smooth surfaces not horizontal, but with a downward inclination towards the circumference, so as to let the flour run out more easily. Hand-mills of this description are used in Palestine to the present day.

QUESÁLTENANGO, a town in Central America, in the state of Guatemala, 88 miles W.N.W. of the town of Guatemala, and capital of the department of the same name. It ranks next to the capital. It has regular and paved streets, and houses which are well, though somewhat fancifully, built; and a large and imposing church, with a richly-decorated front; and several other substantial edifices; and an extensive trade in wheat, cacao, sugar, and woollen and cotton fabrics. Its climate is remarkably healthy. Pop. about 20,000.

QUESNAY, François, a French physician of some eminence, but chiefly noted as a writer on political economy, was born at Montfort-l'Amaury, in the department of Seine-et-Oise, in 1694; and died at Versailles in 1774. His father was a farmer, and he acquired the rudiments of his profession under a country surgeon; after which, going to the metropolis, he pursued his studies further there. After having passed as a master in surgery he established himself at Mantes, where his success in treating wounds brought him under the notice of Marshal de Noailles, who recommended him to the Queen Marie Lesczinska. In 1731 he accompanied the Duke de Villeroi as surgeon to Paris. Here he was appointed surgeon in ordinary to the king, and in 1737 was appointed secretary to an academy or society that had just been organized for the improvement of surgery. In 1744, having been disabled by repeated attacks of gout from performing surgical operations, he took the degree of M.D., and obtained the situation of physician to Madame de Pompadour, the mistress of Louis XV., and through her interest became physician to the king. Amid the intrigues of a licentious court he observed a simplicity of manners and apparent disinterestedness which formed a strong contrast with the characters of those around him. Towards the latter part of his life he became the founder of the political sect of the economists. He was the author of various surgical and medical works; several articles in the Encyclopédie (Fermiers, Grains, &c.), in which he expounds his economical views; and tracts on politics, including a treatise on the Physiocratic system (Physiocratie, 1768, 8vo).

QUESNEL, Pasquier (Paschasius), a theologian and moralist, born at Paris in 1634; died at Amsterdam, December 2, 1719. He became a member of the order of the Fathers of the Oratory in 1657, at that time a great nursery of Jansenism. Almost immediately he set about the composition of a number of devotional works; but the first important work published by him was Réflexions morales sur le nouveau Testament, consisting of some thoughts on some of the most beautiful maxims of the evangelists. This word rendered him celebrated, but brought him under the suspicion of the church on account of its Jansenistic tendencies. This feeling was increased by an edition of the works of Leo the Great that he published in 1675, and in which he indulged in great freedom of expression. In 1681 he found it advisable to quit Paris, and retired for a time to Orleans. In 1685 he was compelled to seek safety by leaving French territory altogether. He went to Brussels, where Arnauld was then residing, and here he applied himself to the continuation of his work on the New Testament, which was published entire in 1693–94. In this some leading points of Popery were freely questioned. Bossuet and Noailles, archbishop of Paris, rather approved of the book; but the Jesuits, chiefly out of spite to the latter, laboured to procure a condemnation of it; and having gained the ear of Louis XIV. by his Confessor Letellier, obtained through his means, from Pope Clement XI., a bull condemning 101 of Quesnel's propositions as heretical. This bull, the notorious Unigenitus (promulgated at Rome September 8, 1713), not only stirred up the Jansenists, but awoke bitter dissensions in the bosom of the Gallican Church, as to the recognition or non-recognition of it, the approvers taking the name of Constitutionists or Acceptants, and the opposers that of Appellants, given to them because they appealed from the pope and his bull to a general council. Meantime Quesnel had been compelled to flee from Belgium also (1703), and having escaped to Holland he resided for the rest of his life at Amsterdam, where he founded several Jansenist churches.

QUEVEDO-VILLEGAS, Don Francisco de, a Spanish poet and prose writer, was born at Madrid in 1580, and studied at Alcala de Henares. Besides the ancient languages his course of studies comprised theology, medicine, and philosophy, as he was unwilling to devote himself to any professional pursuit. He combined extensive learning with much wit and great originality. In consequence of a duel, in which his adversary fell, he fled to Italy, where his services gained him the confidence and friendship of the Duke of Ossuna, viceroy of Naples. After having visited Germany and France Quevedo returned to Spain, and on account of his connections with the duke, then in disgrace, he was arrested and confined to his estate, La Torre de Juan, for three years (1620–23). After his liberation he travelled through Spain to restore his health, impaired by his confinement, and afterwards lived for some years in retirement on his estate, where he occupied himself in writing political satires, burlesque poems, and pamphlets, which obtained an extraordinary degree of success. The first minister, the Count of Olivarez, resolved to attach him to himself, and offered him several high posts, but Quevedo would only accept the office of secretary to the king (1632). In 1641 (according to others

1639) he exposed himself to the wrath of Olivarez, by causing some stanzas he had composed, depicting the sufferings of the people and the abuses of the government, to fall under the eyes of the king, and for this he was confined till the fall of the ministry in 1643, in a dungeon of the royal convent of St. Mark de Leon. By this second imprisonment his health was completely shattered, and he died about two years after his release, September 8, 1645. His works are various in their character. His humorous productions are distinguished for playfulness, wit, and invention. His prose works are mostly effusions of humour and satire. His Visions (Sueños) have been translated into most European languages (English, by L'Estrange); his Vida del Gran Tacaño is a comic romance of the sort, called by the Spaniards *picaresco*. He also translated the Enchiridion of Epictetus into Spanish. His works have been frequently reprinted.

QUIBERON, a peninsula on the western coast of France, in the department of Morbihan, containing a market-town of the same name and several hamlets. The place owes its celebrity to the defeat of a small army of Chouans and émigrés which took place here in 1795. On the 27th of June in that year a body of 1200 to 1500 émigrés, under the command of the Count d'Hervilly, landed on this coast and took possession of the peninsula, where they were afterwards joined by several thousand royalists and Chouans. The advance of the republican forces under Hoche compelled them to confine themselves to this corner of land, under the protection of Fort Penthièvre and the English squadron by which the émigrés had been brought over. July 16 d'Hervilly attempted a sortie, in which he fell. On the 17th a reinforcement of émigrés landed, under command of Sombreuil. On the 21st the fort was taken by the republicans, who penetrated into the peninsula; and on the 23d Sombreuil surrendered, with 4000 men, after a brave resistance. The young Sombreuil (twenty-eight years old), whose father and brother perished under the guillotine during the revolution, and about 200 of the royalists, were shot. In 1829 a chapel was erected here, containing a marble monument, ornamented with bass-reliefs by David d'Angers, to the memory of the émigrés who fell on this occasion.

QUICK (or QUITCH) GRASS. See COUCH-GRASS.

QUICK (or QUICKSET) HEDGE, among gardeners, denotes all live hedges, of whatsoever sorts of plants they are composed, to distinguish them from dead hedges, but in a stricter sense the term is restricted to those planted with hawthorn.

QUICKLIME. See LIME.

QUICKSILVER. See MERCURY.

QUIETISM, a religious movement of the close of the seventeenth and beginning of the eighteenth centuries. Its name is derived from the Latin *quies*, rest, because perfect rest or tranquillity of soul was considered by the adherents of the movement as the great end of life. Those who embraced Quietism were called *Quietists*, and sometimes *Hesychasts*, a term derived from the Greek of the same signification. The ceremonial and hierarchical spirit of some monastic orders, especially of the Jesuits and Dominicans, had in the seventeenth century almost converted religion among the Catholics into a mere mechanical service. The repetition of forms of prayer from the breviary and on the rosary, fasting, confession, frequent pilgrimages, invocations of the mother of God and of saints, almsgiving, the purchase of indulgences, and, in a word, the minute observation of external forms, came to be viewed as real piety. Pious minds, disposed to a more earnest devotion, turned with ardour to mysticism, which afforded refuge and spiritual aliment to the more feeling soul, when all religion seemed to have become petrified in the forms of ritual observances. The Spiritual Guide (Guida Spirituale), a work published at Rome in 1675, by Michael Molinos, a Spanish priest, answered this want. With an enthusiasm which soon gained favour to his pious fancies Molinos spoke of the tranquillity of a soul absorbed in the deity, which, dead to all other thoughts and feelings, and disturbed by no outward events, had perception of nothing but the presence of God. In obedience to his instructions the devout now sought solely this tranquillity of soul, and no opposition would have been made to them but for the danger that the devotional exercises enjoined by the church and the monastic orders would appear superfluous. Molinos was obliged to abjure his errors, and terminated his life in daily acts of penance in a Dominican convent in Rome. (He died in 1696.) But this violence by no means prevented the diffusion of Quietism. The Spiritual Guide was eagerly studied, and produced a number of similar works in Germany and France, where the way had already been prepared for its reception by the works of Bourignon, Poirets, and the Pietists. As early as the fourteenth century there was a body of monks called Hesychasts, who spent their whole time in prayer and meditation. (See HESYCHASTS.) The most celebrated promoter of Quietism in France was a beautiful and rich widow, a favourite at the court of Louis XIV., Joanna Maria Bouvier de la Motte Guyon, who, under the name of Madame Guyon, is celebrated as an amiable enthusiast of more imagination than judgment. Her example, her prayers, her works, replete with unction, and the exertions of her confessor Lacombe, gained her adherents enough to excite the attention of the clergy. There were, indeed, strong reasons for believing a young woman crazy who imagined herself the pregnant woman of the Apocalypse (xii. 2), and who, in her own account of her life, says that she was often filled with such an overflowing of grace that she was literally on the point of bursting, and that it became necessary to loosen her clothes, upon which this fulness of grace was poured out upon those who did her this service. Lacombe was thrown into prison at Paris, and died in confinement in 1702; but Madame Guyon herself, after a short imprisonment, was restored to liberty, and had the honour of being allowed to take part in the prayers of Madame de Maintenon at St. Cyr. The controversy therefore seemed at an end, when Fénelon thought he discovered in Madame Guyon a kindred spirit, and became the advocate of her and her writings in his Explication des Maximes des Saints sur la Vie intérieure (1697). The accession of so distinguished a man, whose works of devotion had been received in France with enthusiasm, gave new weight to Quietism, and an opportunity to Bossuet, the champion of the French theologians, to inflict disgrace on his envied rival. Bossuet obtained, in 1699, a Papal brief which condemned twenty-three positions from Fénelon's book as erroneous; but the humility with which he submitted, and which was admired even in Rome itself, deprived his enemies of the fruits of their victory; and it was the change in the spirit of the times and not violence—though Madame Guyon (who died 1717) underwent another short imprisonment—that gradually buried Quietism in oblivion. It had never formed a sect; but for some years it continued to be the subject of works of devotion and the peculiar opinion of a party among the pious. From Fénelon's book, in which Quietism is most clearly described, we learn that it was a harmless enthusiasm, adapted only to persons of a fanciful and exaggerated turn of thinking. Truth and falsehood are strangely blended in it; it

requires pure love, which, without fear or hope, indifferent to heaven or hell, is directed with entire self-denial to God, merely because he wills it. The flesh must be mortified, every worldly feeling banished, all confidence in our own merits by good works abandoned, and the soul be transferred to a passive state in which its own activity ceases and God alone works in it. This state, which unites the soul essentially with God, is tranquillity, or incessant internal prayer (the permanent direction towards God), in which nothing is desired, nothing asked from God, but, entirely resigned to him, the soul is contented with the pure contemplation of his being. Rarely as these precepts of Quietism can be put in practice, because they comport neither with the wants of human nature nor the demands of our social condition, they have nevertheless frequently reappeared in the mysticisms of later sects. The term has also been applied to the religious notions of the Indian Brahmans, whose object is to attain a state of holiness by the destruction of all corporeal and intellectual activity, and thus to become incorporated with Brahma. See Madame Guyon's Life by herself.

QUILLIMANE, a town in Eastern Africa, in the Portuguese territory of Mozambique, about 15 miles above the mouth of a river of the same name (the northern branch of the Zambesi). It occupies an unhealthy marsh; and consists of some substantial brick houses, and numerous huts formed of reeds, and thatched with coarse grass. It carries on a considerable trade in ivory, tortoise-shell, rhinoceros horns, hippopotamus teeth, wax, tobacco, rice, &c. Pop. 3500, or, including the surrounding district, about 15,000.

QUILLOTA, a town in Chili, in the province of Aconcagua, in a beautiful and fertile valley, 23 miles north-east of Valparaiso, which is supplied by it with fruits and vegetables. The copper-mines in the vicinity are regarded as the richest in Chili. The town was founded in 1726, and has since suffered severely on different occasions from earthquakes, particularly in 1826. Pop. about 8000.

QUILLS. The principal use of quills is still for making pens, although they have been so largely superseded by steel and other metals for this purpose. The best quills for pens are those of the swan, but goose-quills are the most commonly used. Crow-quills are used for fine writing and pen-and-ink drawing. In preparing quills for being made into pens the essential process is to cleanse them inside and outside of a fatty matter with which they are impregnated, and which, if not removed, prevents the ink from flowing freely. The Dutch were the first to discover a method of doing this, which consisted in burying the quill ends of the feathers for a few seconds in hot cinders or ashes. Very fine sand at a temperature of about 140° Fahr. is now used instead. After being taken out of the sand-bath the quills are strongly rubbed with a piece of flannel, which makes them white and transparent. A yellow tint is sometimes given to quills by dipping them for a short time in dilute hydrochloric acid, and afterwards drying them thoroughly. (See PEN.) Quills, instead of being used whole for pens, are now frequently cut up to make pen-nibs. They are also used for making brushes, artificial flowers, imitative horse-hair work, and a number of other articles, and the feather-ends have even been woven into fine tissues.

QUILTING, a method of sewing two pieces of silk, linen, or stuff on each other, with wool or cotton between them, by working them all over in the form of chequer or diamond work, or in flowers. The same name is also given to the stuff so worked.

QUIMPER, or QUIMPER-CORENTIN, a town in France, capital of the department of Finistère, 4 miles south-east of Brest, at the confluence of the Odet and Eir, and at the head of the estuary into which these small streams flow. It consists of an old and a new town, the former with walls flanked by towers, but very poorly built; and the latter containing a number of good mansions. The principal edifices are a fine Gothic cathedral (begun in the thirteenth century, and only completed within the last few years), with a richly-sculptured portal between two massive towers; the ruins of a Cordelier church and cloister; the college, which formerly belonged to the Jesuits; the prefecture, military hospital, theatre, &c. The manufactures are delft and earthenware, leather, and cordage; and at the harbour, formed by two quays along the Odet, and accessible to vessels of 300 tons, a large trade is carried on in salt, wines, coal, and manure (which are imported), and grain, flour, earthenware, and fish (which are exported). The sardine fishery forms an important occupation. Pop. 15,288.

QUIN, JAMES, an eminent English actor, born in London in 1693, was the son of an Irish barrister, and was educated in Dublin. His father had married a supposed widow, whose husband, after a long absence, returned and claimed her; on which account Quin, who was the offspring of the connection, was deemed illegitimate, and upon his father's death in 1710 was left without a fortune. This interruption of his prospects prevented him from being adequately educated for a profession, and in 1714 he had recourse to the Dublin stage, and in a year after secured an engagement at Drury Lane Theatre. In 1717 he quitted Drury Lane for the theatre in Lincoln's-Inn-Fields, where he remained seventeen years, and gradually acquired celebrity in characters of grave, dignified, and sententious tragedy, as in Cato, Zanga, and Coriolanus (in Thomson's tragedy of that name), and in those of strong, sarcastic, comic humour, as Falstaff, Volpone, and Sir John Brute. In 1732 he removed with the same company to Covent Garden, but in 1735 was induced to join that of Fleetwood at Drury Lane, on such terms as no actor had previously received; and he retained the pre-eminence until the appearance of Garrick in 1741. In 1747 he was engaged at Covent Garden with Garrick; but the new actor obtained so great a share of attention as gradually to induce Quin to retire as a professional actor, although he occasionally performed subsequently for the benefit of his friends. His last performance was Falstaff (1753), in which character he is supposed never to have been excelled. He survived his retreat several years, which he spent chiefly at Bath, where his fund of anecdote and pointed sense made him much sought after. Quin, who was convivial and too fond of the bottle, was often coarse and quarrelsome on these occasions, which led to two or three hostile encounters, one of which proved fatal to his antagonist. He was otherwise manly, sensible, and generous; and his deliverance of Thomson, although then unknown to him, from an arrest by a present of £100, is much to his honour. He had an imposing presence, an expressive eye, and a finely-toned and sympathetic voice. He died at Bath on the 21st of January, 1766, aged seventy-three. Garrick, once his rival and afterwards his friend, wrote the epitaph for his monument in Bath Cathedral.

QUINALT, PHILIPPE, the most distinguished of French opera writers, born at Paris in 1635; died there in 1688. Before the twentieth year of his age he brought out some plays, and for several years continued to write with success for the stage. His success, however, only rendered him a mark for the satire of Boileau, who attacked him with so much bitterness as to have injured his own fame. Quinault then abandoned tragedy, which he felt not to be his province, and connecting himself with Lully laboured

for the opera. In this lyric department of poetry he displayed such talents as to be placed above all his competitors, and to be ranked by the best judges among the most distinguished men of the age of Louis XIV. There is nothing in the French language more delicate, tender, and ingenious than the turn of his songs and love dialogues. Boileau and the other censurers of Quinault attributed the success of his pieces solely to the merit of Lully's music; which, however, is now forgotten, while Quinault's verse is always read with pleasure. His Armide and his Atys are master-pieces in their kind. In 1661 Quinault married the widow of a rich merchant, and the fortune that he obtained with her, together with a pension that was granted him a few years later by the king and the sums he received from Lully for his librettos, rendered his circumstances easy. In 1670 he was admitted into the French Academy. Besides his theatrical pieces, he was the author of several occasional poems of little value. His works were published in 1739 and in 1778, in five volumes, with a life prefixed. An edition of his selected works appeared in 1824.

QUINCE (*Cydonia vulgaris*), a low tortuous tree, belonging to the natural order Rosaceæ, named after the ancient town of Cydon, in Crete, from which place it was said to have been introduced into the other parts of Europe; but it appears to grow wild in Western Asia and some of the neighbouring parts of Europe. It is now cultivated throughout Europe and in many parts of the United States for the sake of its fruit, which, though hard and austere when plucked from the tree, becomes excellent when boiled and eaten with sugar, or preserved in syrup, or made into marmalade. Quinces when mixed with other fruit in cookery communicate a pleasant flavour; and a wine may be made from their juice, mixed with sugar in the proportion of one quart to the pound, and fermented. The leaves of the quince-tree are alternate and entire; the flowers are large, white, sometimes with a blush of rose; and the fruit is somewhat pear-shaped, yellowish, and cottony, internally containing five cartilaginous cells, in each of which the seeds are arranged in two series to the number of eight and upwards, and covered with a mucilaginous substance. This character of the numerous seeds is the principal circumstance in its structure which distinguishes the quince from the apple and pear. The rind contains œnanthic ether, to which its peculiar fragrance is due.

QUINCY, the name of two towns and several villages in the United States.—1. A town in Adams county, Illinois, on the left bank of the Mississippi, 105 miles direct, and 170 by the river, north-west of St. Louis. It has various manufacturing establishments, including tobacco manufactories, foundries, machine-shops, saw and flour mills, and an extensive and rapidly increasing trade. Large numbers of hogs are packed here. The haven is one of the best steamboat landings in the Mississippi. Pop. (1880), 27,268.—2. A town in Norfolk county, Massachusetts, on Braintree or Quincy Bay, a branch of Boston harbour, about 7 miles south by east of Boston. It has various manufactures; but the most important and lucrative employment is the working of the quarries, which furnish the well-known Quincy granite, of which some of the finest edifices in the United States are constructed. The fisheries also are important, and a considerable number of vessels are fitted out in the building-yards. Quincy numbers among its natives the two presidents, John Adams and John Quincy Adams, father and son. Pop. 10,570.

QUINCY, Josiah, an American writer born at Boston, February 4, 1772; died July 3, 1864. He was educated for the law, but preferred the sphere of politics. In 1805 he was returned to Congress in the interests of the Federal party, which during the whole of his career in Congress, extending to 1813, was in a hopeless minority. After his retirement from Congress he was elected a member of the senate of the legislature of Massachusetts, and continued to hold this position till 1821, when he lost his place in the senate, but was returned to the house of representatives, of which he was elected speaker. This post, however, he only retained for one year. From 1829 to 1845 he was President of Harvard College. His principal works are Memoir of Josiah Quincy, junr., of Massachusetts; History of Harvard University; Municipal History of the Town and City of Boston during Two Centuries; Life of John Quincy Adams.

QUINET, Edgar, a French philosopher, poet, historian, and politician, born at Bourg-en-Bresse, in the department of Ain, Feb. 17, 1803; died March 27, 1875. His early studies were classics, modern languages, history, and law; and in connection with these studies he seems to have written a number of juvenile works that were never published. His first published work was a translation of Herder's Ideen zur Philosophie der Geschichte der Menschheit, to which he prefixed an introduction (1825). A year or two after the publication of this first work he went to Germany to study philology at the University of Heidelberg, and here he composed two other works of a semi-philosophical nature. In 1828 he accompanied a scientific commission to the Morea, and after his return published De la Grèce moderne et de ses rapports avec l'antiquité (1830). During his absence the revolution of July had taken place, and on his return he testified his joy, and expressed his strongly democratic views in a number of political brochures. At the same time he contributed to the Revue des Deux Mondes a series of poems and articles of a more purely literary cast, and all distinguished by the excellence of their style (1831–39). During this period he also wrote a remarkable poetical work, Ahasvérus, censured by some as cloudy, and by others as also dull, in which he professes to give the history of the world, of God in the world, and finally of doubt in the world. This was finished during a journey he made to Italy in 1832–33, after the death of his father, and was published in the latter year. To the same period belong other two epics, Napoleon (1836) and Prométhée (1838), in which also he gave expression to his democratic ideas. In 1839 he published in two volumes, under the title of Allemagne et Italie, a selection of his contributions to the Revue des Deux Mondes. In the same year he was appointed professor of foreign literature at Lyons, where his lectures, which contained the first sketch of his treatise Du génie des religions (1842), attracted large numbers of hearers. In 1841, in spite of his pronounced republicanism, he received from Villemain, then minister of Louis Philippe, the chair of southern literature in the Collége de France. Here, in concert with his two friends Michelet and Mickiewicz, he made it his mission to inspire his audience with the love of political and religious liberty. He delivered a course of lectures on or rather against the Jesuits, which were received with storms of applause on the one side, and of denunciation on the other. In 1843 the lectures were published under the title of Les Jesuites, in the same volume with a number of lectures of Michelet's having the same drift, and this volume excited as much attention as the lectures themselves had done when orally delivered. It passed through numerous editions in French, and was translated into several European languages. The lectures delivered by him in subsequent courses were in a similar strain, and in December, 1846, his class-room was closed by the government, and was not reopened till

after the revolution of 1848. In the events of this revolution Quinet had taken an active part. He was appointed colonel of the 11th legion of the national guard, and soon after was elected a member of the national assembly by the department of Ain, which re-elected him as their representative in the legislative assembly in May, 1849. After the election of Napoleon as president of the French republic Quinet was exiled by the decree of the 9th of January, 1852. His exile, which lasted till after the revolution of 1870 (since he refused to take advantage of the amnesty of the 15th of August, 1858), somewhat embittered his spirit, but ripened his talents, and the numerous works which he produced during this period include some of his best. Among them are the second volume of the Revolutions d'Italie (1852), the first volume of which had been published in 1848; Les Esclaves (1853); Marnix de Sainte-Aldegonde (1854). These appeared during his residence at his first place of exile, Brussels; but in 1858 he removed to Switzerland, where he produced Merlin l'enchanteur (1860); L'Histoire de la campagne de 1815 (1862); La Révolution (1865); La Création (1870). After his return to France he was elected by the department of the Seine a member of the national assembly, where he took his seat on the extreme left. Two remarkable works were published by him during this last period of his life, La République, condition de la régénération de la France (1872), and L'esprit nouveau (1874). An edition of his complete works was begun in 1856.

QUININE ($C_{20}H_{24}N_2O_2$), a white, crystalline substance, inodorous, very bitter, and possessed of marked anti-febrile properties. It is obtained from the bark of several trees of the order Cinchonaceæ (which see; see also BARK, PERUVIAN). Quinine forms a large series of well-marked salts, the most important of which is the sulphate. *Sulphate of quinine* has the formula $2C_{20}H_{24}N_2O_2.H_2SO_4$; it crystallizes in scales or in long flexible needles; it is very light, has a bitter taste, and effloresces quickly in the air. Quinine also forms a series of derivative products, in which the hydrogen is partly replaced by various radicles. The proportion of quinine varies in various cinchona barks from 0·3 to about 2·2 per cent. Its composition was first determined by Liebig in 1838.

QUINOA. See CHENOPODIUM.

QUINQUAGESIMA, name of the Sunday before Lent, because fifty days before Easter. The name was formerly given also to Pentecost, as falling fifty days after Easter, but in this case it was distinguished as *Quinquagesima paschalis*.

QUINSY, the common name for *cynanchē tonsillaris* or *tonsillitis*, inflammation of the throat. The name has gradually been corrupted through the French, from the Greek and Latin *cynanchē* or *kynanchē*. The oldest form in which it appears in English is *squinancy;* it then becomes *squinzey*, and finally *quinsy*. The inflammation is generally ushered in by a feeling of uneasiness in the part. The voice is husky and altered in tone; the pain gradually becomes very severe, shooting along the course of the Eustachian tube towards the ear. There is often swelling of the glands of the neck, and for the most part loss of appetite, thirst, headache, and a considerable degree of general fever. On looking into the back part of the mouth, the tonsils, uvula, and even the soft palate are seen to be swollen and vascular. The tongue is generally foul and furred. In severe cases respiration is considerably impeded, and swallowing is always difficult and painful, so much so that in some cases only fluid aliments can be taken by the patient. The inflammation of the throat may terminate either in resolution or suppuration. When the latter is the case the patient's sufferings are generally aggravated, and the difficulty of breathing and swallowing increased; but when the matter produced by the suppuration is discharged almost immediate relief and rapid recovery follow. The most frequent cause of this affection is cold, produced by sudden vicissitudes of weather, or sudden changes of temperature, as by persons suddenly coming out of a heated room into a cold night atmosphere. But in a great many cases it will be found that the patient has been predisposed to the disease, owing to his digestive organs being in a bad state previously; and persons who have long been subject to this complaint on the slightest exposure to cold have succeeded by attention to the state of their stomach and bowels in keeping free of the disease.

This disease is one difficult to manage, unless the patient be seen at the commencement; and even then in persons subject to the complaint it will often run its course in spite of the most active treatment. In most cases, however, if prompt measures are taken an attack may be arrested, or at least mitigated. The best treatment for this purpose is to administer a dose of some strong purgative, and to follow that almost immediately with an emetic. Sinapisms or light stimulating liniments should be applied to the throat during the course of the disease, and flannel should constantly be worn round the neck. Gargles are sometimes used, but the gargling is apt to produce irritation, and the best local remedy is the inhalation of the steam of warm water. The best method of doing this is to fill a basin or bowl with warm water, or vinegar and water, to place it on the centre of a towel, and to gather up the ends of the towel round the face, and to keep the mouth open so as to allow the steam to ascend into it. The bowels should be kept gently open, and a degree of perspiration kept up until the disease begins to give way; and the diet should be light, consisting of arrow-root, sago, or Iceland moss, with plenty of diluent drinks.

QUINTAIN, an apparatus used in a military sport or exercise by men on horseback, formerly practised in England to try the agility of the country youth. The quintain was an upright post with a cross-bar on the top of it, turning round on a pivot. To one end of the bar was suspended a bag of sand, the other end was broad and flat. The horseman had to ride tilt at the flat end with his lance, and endeavour to strike it and pass on before the bag of sand could whirl round and strike him on the back.

QUINTAL, an old French weight, equal to 100 livres, or 108 lbs. avoirdupois very nearly. The *quintal métrique* is 100 kilogrammes, or 220 lbs. avoirdupois.

QUINTANA, MANUEL JOSÉ, one of the most celebrated of modern Spanish poets, born at Madrid in 1772, studied at Cordova and Salamanca, and then took up his residence in the college of advocates. Here he filled in succession the offices of fiscal agent to the junta of trade, theatrical censor, general secretary to the central junta, acting secretary to the king, and secretary to the department for the interpretation of foreign tongues. At the time of the first ruling cortes he was elected member of the supreme censor junta. Almost all the proclamations and manifestoes in the war of independence were composed by him, and he also wrote a series of patriotic poems, entitled Odas a España Libre (1808). He edited the journal Variedades de Ciencias, Literatura, y Artes, and founded the Semanario Patriotico, which vigorously attacked the ascendency of Bonaparte. After the restoration he was confined in a fortress, and first obtained his freedom in 1820, when he was replaced in his former offices, and also named president of the newly-formed general directorship of studies. In 1823, however, he was again deprived

of all public employment, and lived retired on his property in the country till 1828, when permission was given him to return to Madrid. Another political change in 1833 brought him once more on the stage of public life, and he was named member of the council of state. After the erection of the first chamber he was elected a senator, was repeatedly secretary to the chamber, became also tutor to the queen, and was named president of the council of studies. He is one of the few writers of modern Spain who has earned for himself a European fame, his poetical, critical, and historical works being held in the highest estimation, not only in Spain, but also in foreign countries. His first lyric ode, published in 1795, and entitled Oda a Mar, attracted general attention. His poems are distinguished by the selection of subjects bearing directly on the interests of humanity and of his country, by a philosophical tendency, a patriotic spirit, and a vigorous manly style. As a historian, or rather biographer, he has made himself well known by his Vidas de Españoles Celebres, which holds a place in the front rank of classical Spanish prose. His complete works form the nineteenth volume of the Biblioteca de autores españoles (Madrid, 1852).

QUINTESSENCE (from *quinta essentia*, the fifth essence, by which the Pythagoreans meant the æther), in chemistry, the concentrated extract of the virtues of a substance; hence, in general, the purest, best, or highest state of a quality.

QUINTET, or QUINTETT (Italian, *quintetto*), a vocal or instrumental composition in five parts, in which each part is obligato, and performed by a single voice or instrument.

QUINTILIANUS, MARCUS FABIUS, a Roman rhetorician, born at Calagurris (Calahorra) in Spain, probably between 35 and 40 A.D.; died, it is supposed, about 118. At an early age he was brought to Rome, where he attended the lectures of Domitius Afer. He afterwards revisited Spain, and on coming to Rome a second time (about A.D. 69) began to practise as an advocate, and subsequently became a teacher of rhetoric. Some of the most eminent Romans were his pupils, and the Emperor Domitian bestowed on him the consular dignity. During the reign of that emperor Quintilian wrote his excellent work, De Institutione Oratoria, which contains a system of rhetoric in twelve books; it exhibits him as a practised master, a man of taste and talents, and a worthy imitator of Cicero. The tenth book, which contains his opinions of Greek and Roman writers, is particularly interesting and important for the history of literature, and is characterized no less by acuteness than cogency of reasoning. There are also a considerable number of rhetorical speeches (*declamationes*) attributed to him, but they are not considered genuine. A treatise, De Oratoribus sive de Causis corruptæ Eloquentiæ, is often published with his works, but is also ascribed to Tacitus and to other writers. The best editions of Quintilian are those of Burmann (Leyden, 1720, two vols. 4to), Capperonier (Paris, 1725, fol.), Gesner (Göttingen, 1738, two vols. 4to), Spalding and Zumpt (Leipzig, 1798–1829, five vols.), and Bonnell (Leipzig, 1854). There are also special editions of the tenth book, among which are those of Bonnell (Leipzig, 1851) and Krüger (Leipzig, 1861).

QUINTUPLE ALLIANCE. See QUADRUPLE ALLIANCE.

QUINTUS CALABER, or SMYRNÆUS, a Greek poet, the time and place of whose birth are uncertain. His surnames are derived from the discovery of his poem in Calabria (in a convent at Otranto), and his mention of Smyrna as the place of his residence. He probably flourished in the fourth century A.D. His poem, Paraleipomena Homērō (Supplement to Homer), is a continuation of the Iliad, in which Homer is indeed imitated, but by no means equalled in grace and simplicity. A critical edition of this work, by Tychsen, with remarks by Heyne (Strasburg, 1807), was published at the expense of the Bipont Society. Köchly's edition (Leipzig, 1853) is the latest.

QUINTUS CURTIUS. See CURTIUS.

QUIRE (French, *cahier*), twenty-four sheets of paper. Twenty quires make a *ream*.

QUIRINUS, among the Romans, a surname of Romulus after he had been raised to the rank of a divinity; and at a later period of Mars and Janus, sometimes also of Augustus (in Virgil's Georgics, iii. 27). It is supposed to have been derived from the Sabine word *quiris* or *curis*, which is said to have signified a spear, and figuratively a soldier. The terms *Quirinalia*, a festival in honour of Romulus, held annually on the 13th day before the Kalends of March, according to the Roman way of counting, that is, the 17th of February; and *Quirinalis*, one of the seven hills of Rome, are of the same origin. The hill is supposed to have obtained its name from the fact that a temple was erected on it dedicated to Quirinus.

QUIRITES, originally the inhabitants of Cures, one of the principal of the Sabine towns, and hence the name of that portion of the Sabines who at an early period joined with the Romans. After this union the name was assumed along with that of Romani as a general appellation of the two peoples, but Quirites came to be applied to them in their civil capacity, while Romani was applied to them in their political and military capacity. On this account it was regarded by the soldiers as a great indignity to be addressed as Quirites, and Julius Cæsar is said on one occasion to have quelled a rising mutiny among his troops merely by using this word in the speech in which he harangued them.

QUI TAM ACTIONS, in English law, popular actions on penal statutes, partly at the suit of the crown and partly at that of an informer. They are so called from the words 'Qui tam pro dominâ reginâ, quam pro se ipso sequitur' (Who sues both on behalf of the queen and on his own behalf).—(Wharton's Law Lexicon.)

QUIT-CLAIM, in law, signifies a release of any action that one person has against another. It signifies also a quitting of a claim or title to lands, &c.

QUITO, the capital of Ecuador, in a ravine on the east side of the volcano of Pichincha, 9540 feet above the level of the sea, 170 miles N.N.E. of Guayaquil, a little to the south of the equator. Its streets, with exception of four which meet in the large central square, are narrow, uneven, badly paved, and extremely dirty; and the houses, built for the most part with sun-dried bricks, and thatched with the leaves of the maguey or chagarquero (*Agave Americana*), possess no architectural merit. The more important public buildings and establishments are the cathedral, several other churches and convents; the town-house, court-house, president's palace, two colleges, one of them occupying part of the extensive and handsome buildings of the old Jesuit college, but both under very indifferent management; the episcopal palace, orphan asylum, and hospital. The manufactures consist chiefly of woollen and cotton goods, which, though coarse, are substantial and in considerable demand; lace, hosiery, and confectionery, the last in high repute, and of cloaks, mattresses, and a variety of other articles made from the best kind of caoutchouc obtained from the *Siphonia elastica;* and the trade in corn and other agricultural produce, sent to Guayaquil in exchange for indigo, iron, and steel, and to Peru in exchange for wine, brandy, oil, and different

metals, is very extensive. The imports from abroad include all kinds of European tissues and hardware. Before the arrival of the Spaniards in South America Quito was the capital of a kingdom of the same name, which was conquered by Huayna-Capac, the twelfth inca of Peru. It was taken by the Spaniards in 1534, and incorporated as a city by Charles V. in 1541. It remained with Peru till 1718, when it fell to New Granada. In 1819 it became one of the towns of the Republic of Colombia, and in 1831 of Ecuador. It has repeatedly suffered much from earthquakes. In that of 1797 40,000 persons are estimated to have perished. Pop. estimated at about 80,000.

QUIT-RENT, in law, a small rent payable by the tenants of most manors, whereby the tenant goes quit and free from all other services. Anciently this payment was called white-rent, because it was paid in silver coin, and to distinguish it from rent-corn.

QUOIN (French, *coin*, Latin, *cuneus*, a wedge), a technical word for a wedge; in artillery, the wedge used to elevate and depress a cannon or other piece of ordnance; in printing, the wedges used to fix pages of type within the chase. In architecture the term is applied to any external angle, but especially to the angular courses of stone projecting beyond the plane surface of the wall at the corner of a building, and specifically designated rustic quoins

QUOITS, a game somewhat resembling the throwing of the discus among the ancients; only the discus was flat, while the quoit is ring-shaped. (See DISCUS.) The quoits are made of metal, usually iron, and are comparatively thick at the inner edge of the ring, but sharp enough at the outer edge to stick in soft clay when properly thrown. In size they vary from 8 to 9¼ inches. The game is played on a ground from 18 to 24 yards in length, at each end of which a pin called a hob is fixed in the ground to serve for a mark. The object of the game is to throw the quoits from one end of the ground to the other so as to make them stick in the ground as near the hob as possible. The best shot, called a ringer, is when the quoit surrounds the hob. The players are divided into sides, and each player has two quoits, which he delivers in succession. The winning side counts one for each quoit that it has nearer the hob than the nearest of the losing side, and if it has a ringer it counts two for it. The rules as to the size of the quoit, the distance between the hobs, and other particulars, vary with different clubs.

QUORUM, a term used in commissions, of which the origin is the Latin expression, *quorum unum A. B. esse volumus* (of whom A. B. shall be one), signifying originally certain individuals, among several persons invested with power, without whom the others could not proceed in the business. Thus among the justices of the peace it was customary to name some eminent for knowledge and prudence to be of the quorum; but all justices are now generally of the quorum. In legislative and similar assemblies a quorum is such a number of members as is competent to transact business.

QUO WARRANTO. See QUEEN'S BENCH.

R.

R, the eighteenth letter of the English alphabet, called by grammarians a liquid. (See L.) This letter is pronounced in various languages, and in several instances even in the same language, in different ways. The most natural mode, at least that which is most agreeable to the ear, and most common in the various languages, is by an expiration, whilst the tongue touches the roof of the mouth with a tremulous motion,—the pronunciation of the English *r* at the beginning of a syllable, as *rhetoric*. This tremulous motion of the tongue makes the pronunciation of *r* more difficult than that of any other letter in the alphabet, so that it is the last which children learn; and if the tongue is too thick, or is too closely joined to the lower part of the mouth, they do not learn it at all. Indeed, the sound of *r* is entirely wanting in some languages, as in Chinese and the languages of some Indian tribes. (See L.) Another pronunciation of the letter *r* is produced by applying the uvula to the posterior part of the tongue and causing it to vibrate distinctly. This is what constitutes the Northumberland burr, the *ghr* sound in Arabic, and the *r grasseyé* of the people of Provence and the Parisians. By the English the letter *r* is distinctly pronounced only when it begins a word or syllable, and not always then. After most vowels it is heard when pronounced by them only as a slight impediment to the emission of the breath in consequence of the tip of the tongue being brought near the roof of the mouth, but not allowed to touch it, and after the vowel *a* in such words as *far*, *farther*, &c., and *o* in *corn*, it is scarcely heard at all. The tremulous motion of this letter produces, in speaking quickly, an uncertainty as to its preceding or following the vowel, so that *r* is transposed oftener than any other letter: *to burn* in English is *brennan* in German; *Brunn* and *Born* (the Scotch *burn*) both in German signify a well; so there are the Latin *cerno* and *crevi*, *pro* and *por;* the Greek *kranion* and *karēnon*, and innumerable other cases. As the pronunciation of *r* differs from that of *l* only by the tremulous motion of the tongue, it is natural that either of them should often take the place of the other. (For some remarks respecting both letters see the letter L.) The pronunciation of the letter *s* is also much allied to that of *r*, as the tongue is in the same position, only allowing the air to pass over the point instead of shaking it. Hence also the frequent alternation of these two letters; as, in Latin, *arena*, with the ancient Romans *asena; ara*, anciently *asa; plurima*, anciently *plusima; honos* and *honor, arbos* and *arbor; hare*, in German *Haas; was*, in German *war;* the German *Rohr*, in Ulphilas *Raas*, and in French *roseau*, &c. The Æolic dialect in Greek substituted *r* for a final *s*, as *houtor* for *houtos, hippor* for *hippos, martur* for *martus*. The R of the Romans was derived from the P (*rho*) of the Greeks. It is the *resh* of the Phœnicians and Samaritans, formed thus, ϥ and ϩ.—As a Roman numeral it signified 80, according to the verse,

Octoginta dabit tibi R, si quis numerabit;

with a dash over it, 80,000. With the Greeks, ρ with the accent over it signified 100; with the same sign under it it was 100,000. The Hebrew *resh* (ר) denoted 200, and (ר) 200,000. R on ancient medals signifies *Ravenna, redux, regia, restitutor, Roma, Romanus*, &c.; P. R., *populus Romanus;* R. P., *res publica;* R. C., *rescriptum*, &c. R, in numismatic works, signifies *rare*, and the different degrees of rarity are indicated by one, two, three, &c. It was

the mark of coins struck at Orléans, and previously of those which proceeded from the mint of Villeneuve-lez-Avignon. R stands, in modern times, for *rex* or *regina*.

RAABE, or NAGY-GYOR, a town in Hungary, capital of the county of the same name, at the confluence of the Raab and Rabnitz with the Danube, 67 miles W.N.W. Buda. It stands in a beautiful plain, almost surrounded by three rivers, and is thus advantageously situated both for defence and commerce. It is the see of a Roman Catholic bishop, and has an episcopal palace, diocesan seminary, two monasteries, a royal academy, gymnasium, and several other schools. Its manufactures are woollen cloth, cutlery, including swords, and tobacco; and there is a considerable trade. Raab was a place of some importance under the Romans, and makes a figure both in the early wars of Hungary and those of still more modern times. On the 14th of June, 1809, the Archduke John of Austria and the Palatine of Hungary were defeated here by the French under Eugène Beauharnais. A great many Roman coins have been found here. Pop. (1880), 20,981.

RAALTE, a town in Holland, one of the prettiest in the province of Overijssel, 9 miles south-east of Zwolle; with a weekly cattle and annual horse markets. Pop. 5795.

RAASAY, or RASAY, an island in Scotland, one of the inner Hebrides, in the county of Inverness, between Skye and the mainland, about 13 miles long north to south, and 2 miles broad at the widest part. It may be considered as forming a single ridge of unequal height, in its southern or highest end averaging 1000 feet, culminating on the flat-topped eminence of Dun Can, 1500 feet, on the south-east coast. The west side of the island is sufficiently uninteresting; on the east it is otherwise; here are numerous scattered farms, each surrounded with its cultivated tract; and the whole diversified by towering rocks, formidable cliffs, and patches of brushwood. On a lofty cliff, beetling over the sea, in the northern part of the east coast, stands the picturesque-looking castle of Brochel. Freestone of the finest quality abounds in this island, as does also limestone and a valuable kind of granite. The herring fishing was at one time carried on here to a great extent, particularly in the Sound of Raasay, the narrow channel which separates the island longitudinally from Skye. Pop. (1881), 478.

RABAT, a maritime town in Marocco, in the province of Fez, on the Atlantic, at the mouth of the Buregreb, and opposite Sallee, 62 miles west of Mequinez. It is surrounded with a wall flanked by numerous towers, and has a citadel and batteries. The streets are steep and inconvenient, but the houses generally have a respectable appearance, and some of them are well built. It has some manufactures (carpets, woollens, cottons, and leather) and considerable trade. Formerly the ships of the pirates of Sallee were built on the slips belonging to this place, but now the only vessels constructed here are a kind of skiffs of little draught used to convey passengers and merchandise across the dangerous bar at the mouth of the Buregreb. In November, 1851, it was bombarded by a French squadron, under Rear-admiral Dubourdieu. Pop. 30,000, including a considerable proportion of Jews.

RABBI, a title of honour among the Hebrews, derived from a root signifying 'much' or 'great,' and hence corresponding to the Latin *magister* (English, *master*), from the root *mag*, having the same meaning. John expressly states that the word was equivalent to 'teacher' (Greek, *didaskalos*, rendered in the Authorized Version 'master;' John i. 38). There are two other forms of the title, *rabboni* and *rabbani*, the first of which is found in the New Testament. All of these are also found without the final syllable (*rab*, *rabbon*, *rabban*), and the *i* at the end may either be regarded as a lengthening of the words without any particular meaning, or as the pronominal affix meaning 'my;' but in any case it came practically to be an essential part of the title. The form rabban was considered the most honourable, and was only applied to seven persons. Rabbi was also looked upon as a higher title than rab. It is supposed that this title first came into use at the period immediately preceding the birth of Christ. In the time of our Lord it was applied generally to all religious teachers, and hence sometimes to Christ himself. Now the term rabbi is applied to regularly appointed teachers of Talmudic Judaism. Since 1831 these have in France been salaried by the state. Their duties are not only to give instruction in the Talmud, but also to draw up deeds of marriage and divorce, to examine butchers, and to give their opinion as to what is legal and what is illegal in the Jewish ritual.

The name of Rabbinical language is frequently given to that form of Hebrew in which the Jewish scholars and theologians of the middle ages composed their works. Grammatically it differs but little from the ancient Hebrew, although there are a few Aramaic forms. But the vocabulary is necessarily considerably different, since words had to be found for many objects and ideas that are not mentioned in the Scriptures. To meet this want the rabbinical writers in many cases attached new meanings to Hebrew words already in use, in other cases made new derivatives according to the grammatical laws of the language from old Hebrew roots, and finally borrowed from the Arabic many words that had already acquired a technical sense in that language. For the acquisition of this language there have been grammars and lexicons, &c., prepared by Cellarius, Reland, Hardt, Tychsen, Buxtorf (Lexicon Chaldaicum, Talmudicum et Rabbinicum; Basel, 1639; new edition by Fischer, Leipzig, 1866, fg.), and others, and the labour of the study is repaid by the richness of the rabbinical literature, which may be learned particularly from the works of Buxtorf, Bartoloccius, and Wolf. Among the authors during the most flourishing period of the middle ages Aben Ezra, David Kimchi (who died about 1240), but especially Elias Levita, are celebrated as grammarians. David Kimchi was also the author of a Hebrew lexicon, which long retained a classical reputation. Of later scholars the principal are Meyer Hallevi (Haramah) of Toledo, in the beginning of the thirteenth century; Menachem de Lonzano and Solomon Norzi, whose labours surpass those of all the preceding in extent and thoroughness. Among the commentators on the Old Testament the most conspicuous are Aben Ezra, a learned philologist, but obscure writer; Solomon Jarchi, a poor linguist, and also obscure writer (died about 1180); Joseph Kimchi (flourished about 1160), one of the most learned of the Jews, and his son David Kimchi, already mentioned as a grammarian, Maimonides, Levi Ben Gerson (before 1370), and Isaac Arbarbanel (before 1508). Maimonides endeavoured to aid the interpretation of the holy writings of his nation by philosophico-theological disquisitions; among the many commentators, he and Raschi were the most distinguished. The above-mentioned Levi Ben Gerson and Lipman of Mühlhausen (1399) wrote in defence of their faith. In respect to the geography of the middle ages Moses Petachia of Ratisbon (before 1187), Benjamin of Tudela (died about 1173), and Perizol of Avignon (about 1550), rendered much service by the descriptions of their travels. Mathematics, likewise astronomy, philosophy, and medi-

cine, were studied with great avidity by the Jews, especially in the schools of the Arabs in Spain; but as few of their scientific works are printed, we must be satisfied with referring to the oft-named Maimonides, who, as a philosopher, mingled the notions of Aristotle and Plato with the Cabala and the Talmud, but who, in his medical works (Aphorismi, and De Regimine Sanitatis), showed himself a follower of Galen.

RABBIT (*Lepus cuniculus*), a genus of Rodent Mammals, included in the family Leporidæ, to which group also belong the Hares (which see) and Calling Hares or Pikas (*Lagomys*). This family is distinguished by its members possessing two small incisors in the upper jaw in addition to the two ordinary incisors, thus making four incisors in the upper and two in the lower jaw, whilst no canines exist in either jaw. The premolars number six in the upper and four in the lower jaw, and the molars exist to the number of six in each jaw. The latter two kinds of teeth are destitute of roots, and the clavicles or collar-bones are of rudimentary nature. The front feet possess five and the hinder have only four toes, whilst the hind legs exceed the fore limbs in length. The tail is short and erect, and the two orbits or eye cavities of the skull communicate by an aperture in the septum or partition which divides them. The Common Rabbit differs from the Hare by its generally smaller size, by the shorter ears of uniform brown colour, and by the shorter limbs. The Hare possesses a redder fur, and greater relative length of ears, which are tipped with black. The hind legs in the Hare are proportionally longer than in the Rabbits, and the eyes are larger and more prominent than in the latter animal. The rabbit's fur in its native state is of a nearly uniform brown colour, whilst under domestication the colour may become pure white, pure black, piebald, gray, and other hues. The texture of the fur also changes under domestication. The Rabbit is a native of all temperate climates, but does not occur native in Australia. It is said to have been originally introduced from Spain into the countries of Europe in which it is now found. Rabbits in a wild state are reared in 'warrens,' the best situations for which are sandy pastures and hill-slopes. The neighbourhood of juniper-trees appears to be favoured by these animals, as they feed readily on the leaves of these plants, with the result of imparting to their flesh a delicate aroma and flavour. The burrows which these forms excavate are irregularly disposed, and communicate freely with each other. They are extremely prolific, and begin to breed when about six months old. They may breed six or seven times a year, producing from five to seven or eight at a birth. The parturient rabbit appears to excavate a special burrow or tunnel for herself in which to give birth to and shelter her progeny, the nest being lined by down plucked from her own body. The young are hairless when born, and have their eyes closed. The eyes open about the tenth or twelfth day. These animals feed on tender grass and herbage, and sometimes do great damage to young trees by stripping them of their bark—a process in which they are greatly assisted by their sharp, chisel-like, incisor teeth. The rabbit seems to have no liking or social feeling for the nearly-allied hare, and it only rarely happens that a hybrid progeny of the two species is produced. In such cases, with one or two exceptions, the father of the hybrids has invariably been a rabbit and the mother a hare. These animals grow exceedingly tame and domesticated, and may exhibit no small degree of intelligence. Their flesh is forbidden to be eaten by the laws both of Moses and Mohammed. They are snared by dogs, ferrets, or nets, or may be shot. Rabbits are subject to certain diseases, such as rot—induced probably by damp and wet—parasitic worms, and a kind of madness.

As to the law with regard to rabbits, it is mentioned in the article GAME LAWS that the owner or occupier of land may catch and kill rabbits on his own ground without a game certificate, but although this right belongs to an occupier, yet he cannot transfer his right to friends, and the landlord may reserve the right entirely by an express stipulation in the tenant's lease. In Ireland no game certificate is required for shooting rabbits, whether the sportsman shoot on his own grounds (or grounds occupied by him) or not: but in England and Scotland a license is in the latter case required.

RABELAIS, FRANÇOIS, a humorous and satirical French writer, author of Gargantua and Pantagruel, was born at Chinon, in Touraine, about 1495 (or according to others, but apparently less probably, about 1483). He was the son of an apothecary, or according to some of an innkeeper. Rabelais, by the desire of his father, entered the Franciscan order at Fontenay-le-Comte, in Poitou, where he received the priesthood about 1511; but the absence of all true learning soon disgusted him with this residence, and his satirical humour, and some youthful indiscretions, no less than his addiction to profane studies, drew upon him the hatred of the monks. He was about to be proceeded against by the superior of the monastery, when he made his escape. Shortly after, through the influence of powerful friends, he obtained the permission of Clement VII. to enter the Benedictine order (about 1523); but in no long time he quitted this brotherhood also, and began to traverse the country under the habit of a secular priest. His biographers have found it difficult to follow him during this period of his life, but it seems that in his wanderings he cultivated all the sciences of the day, and especially philology, with assiduity, and that in this he exhibited powers of acquisition such as few have possessed before or since. In 1530 he was enrolled as bachelor in the faculty of medicine at Montpellier, and from 1531 he practised as a physician with success, although it was not till May 22, 1537, that he obtained the degree of doctor. In 1532 he went to Lyons, where he published editions of Hippocrates and Galen, remarkable for their accuracy, and the first germ of his Gargantua (1532 or 1533), of which, according to his own account, more copies were sold in two months than of the Bible in nine years. This first specimen of the power of Rabelais in the style that has rendered him famous has all the grotesque humour, amounting even to buffoonery, and the variety of marvellous adventures of his later works of the kind, but wants the delicate raillery, the sustained allegory, and profound philosophy, which most students of Rabelais find in the subsequent versions of Gargantua, and still more in the three last books of Pantagruel. The first part of Pantagruel appeared under the anagrammatic pseudonym of Alcofribas Nasier, within a year or so after the first work, bearing the name of Gargantua, and its success was such that it passed through three editions in one year. Soon after its publication he accompanied, probably as physician, Jean du Bellay, on an embassy to Rome, where he remained six months. On his return to France he went first to Paris, summoned there, it is said, by King Francis himself; but not long after he is found again at Lyons, where the Gargantua, as we now have it, first saw the light in 1535. In 1536 he was again at Rome, and on this occasion he obtained from the pope absolution for the violation of his monastic vows, and permission to hold benefices. It was in virtue of this permission that he was enabled to enjoy a prebend granted to him by Jean du Bellay in the abbey of Saint Maur-

des-Fossés. It was on his return from this second visit to Rome that he took the degree of doctor at Montpellier, at the date already mentioned. In the year following he is known to have been practising his art at Paris, but his love of wandering had not yet ceased, and his place of abode for the next eight or nine years was as unsettled as it had been during any previous part of his life. In 1546 he was probably in Paris, when the third book of his Pantagruel appeared. In this book the fantastical and trivial adventures that crowd the previous ones give place in a great measure to regular dissertations, in which all the great moral and social questions of the day are discussed with the gaiety and irony peculiar to Rabelais, and with a freedom that roused the suspicion of the clergy, who endeavoured to have it suppressed. The favour of the king secured the free publication of this book, but it was with more difficulty that a license was obtained for the fourth book from the next king (Henry II.), who had succeeded Francis in 1547. A mutilated edition of this book appeared surreptitiously at Lyons in 1547. The license to publish was not obtained till 1550, and it was only in 1552 that a complete and authentic edition of the book appeared. On the 8th of January, 1551 (1550, according to the mode of reckoning of the time), Rabelais was installed in the cure of Meudon, which he had had bestowed on him by his former patron Jean du Bellay, and here he seems chiefly to have resided during the remainder of his life. He is said by good authorities to have died at Paris, April 9, 1553; but Antoine le Roy, one of the successors of Rabelais in the cure of Meudon, and therefore one who may be supposed to have had access to documents referring to Rabelais now lost, places his death as late as 1559. He left at his death the whole of the fifth book of Pantagruel in manuscript. A sixth book was intended to be added, but there is only a fragment of it indicating its subject, Les Noces de Panurge. Rabelais was one of the first to give flexibility and finish to the yet rude and harsh language of his country. Boileau calls him *la Raison en masque*, and Rousseau, *le gentil maître François*. He was a conscientious teacher of his people, and it was his pleasure to instruct the children of his parish in sacred music. His house was the resort of the learned; his purse was always open to the needy; and his medical skill was employed in the service of his parish. His work cannot now be easily understood without a glossary and commentary. Among the best editions of the Gargantua and Pantagruel may be mentioned that of Le Duchat, with engravings by Picard (Amsterdam, 1711); the Variorum edition, which is the most voluminous (Paris, 1823–26); a splendid edition, illustrated by Gustave Doré, published at Paris in 1858; a one-volume edition by Louis Barré (1864). The last volume of a fine edition of the complete works of Rabelais in five volumes, with notes, and a glossary by Marty-Laveaux, appeared at Paris in 1875.

RABIES, the name given to a disease with which dogs, horses, cats, wolves, and other animals are attacked, and to which, indeed, all animals are said to be liable. A bite from some rabid animals induces hydrophobia in man. See the article HYDROPHOBIA, where an account of the symptoms of rabies in the dog is given.

RACEME, in botany, a form of inflorescence in which the primary axis is elongated, and bears flowers placed on pedicels of nearly equal length. The inflorescence is centripetal or indefinite. A raceme differs from a spike only in the flowers being stalked, instead of being sessile. Examples occur in the currant, laburnum, barberry, &c.

RACHEL, MADEMOISELLE, a celebrated French *tragédienne*, was born at Munf, a village of the canton of Argovia, in 1821, of Jewish parents, and from her earliest years was accustomed to the endurance of great hardship and penury. Her proper name was Elisa Felix. Her original occupation was singing in the streets of Lyons with her sister Sophia, who went by the name of Sarah. Having attracted the notice of M. Choron, director of the Conservatoire of Sacred Music, she was placed at first in his own institution; but when she lost her voice, as she did soon after, was through his recommendation placed under the charge of M. St. Aulaire, a professor of elocution. At first she gave few indications of the powers which she afterwards displayed; but was taken in hand by the celebrated M. Samson, and after a course of instruction at the Conservatoire made her *début* in 1837, at the age of sixteen, on the stage of the Gymnase. She attracted no special attention here; but having been transferred in June of the following year to the boards of the Théâtre Français, took the Parisian public by storm by the admirable manner in which she impersonated the classic creations of Racine and Corneille. Her reputation was speedily established as the first tragic actress of her day; and by 1841 she was in the receipt of a salary of 60,000 francs, or £2400, with three months' leave of absence. The same year she visited England for the first time, and was received with the greatest enthusiasm. Her renown continued to increase, and for many years she reigned supreme at the Théâtre Français, making also excursions to the provincial towns of France, to Belgium, and other places, from which she reaped golden harvests. Latterly she crossed the Atlantic to America, but when there caught a severe cold, which terminated in a consumption. After struggling with the disease for some time, and visiting different localities in search of health, she expired at Cannet, on the shores of Provence, on the 3d of January, 1858. In recording the history of Rachel it is painful to reflect that so much vigour and splendour of genius should have been united with a character singularly devoid both of moral principle and womanly virtues. A grasping and avaricious spirit, restrained by no feelings of honour or propriety, and combined with a fierce and unloving temper, forms a prominent feature in the portrait of Madlle. Rachel. It must be added also that her moral deportment was far from correct, as was unequivocally established by the fact of her being the mother of several natural children. One redeeming point, however, ought not to be forgotten, and that is the unwearied attention which she bestowed on her own relations, and the munificent generosity displayed by her towards her parents and brothers and sisters.

RACINE, a town in the United States, in Racine county, Wisconsin, on the west shore of Lake Michigan, 18 miles south of Milwaukie. Its trade is considerable. It has a fine harbour, capable of admitting vessels drawing 12 feet of water. It has iron-foundries, manufactures of machinery and agricultural implements; tanneries, and flour-mills, and all the carriages of the Racine and Mississippi Railway are made here. Pop. (1880), 16,031.

RACINE, JEAN BAPTISTE, a distinguished French dramatist, born at La Ferté-Milon in Picardy (now in the department of Aisne), December 21, 1639; died at Paris April 21, 1699. Having been left an orphan at the age of four, he was brought up first by his maternal grandfather, and afterwards by his grandmother and aunt, both rigid Jansenists, at Port-Royal-des-Champs, the seat of the famous school of Port-Royal. At the age of ten he was sent to the College of Beauvais, and subsequently to the Port-Royal Institution, where, under the care of Lancelot and Lemaistre, he became a consummate

Grecian. At the age of nineteen he left the Port-Royal, and began the study of philosophy at the Collége d'Harcourt. When his course at this college was completed he was taken in hand by an uncle, who introduced him into the world, and encouraged him to lead a life of gaiety. To this period belong his first literary efforts, an ode called Nymphes de la Seine, which he composed in honour of the king's marriage, and for which he was rewarded by Chapelain, then the dispenser of the royal bounty; and two comedies, now lost, written for an actress who had charmed him. About the same time he became intimate with La Fontaine, and this intimacy was far from tending to make his life more regular, so that those of his relations who took most interest in him, and who had destined him for the church, began to be rather anxious about his prospects. In the hope of weaning him from his dissipation, and turning his thoughts again in a more serious direction, they sent him in 1661 to live with an uncle, R. P. Sconin, a canon-regular and vicar-general of the cathedral at Uzès (department Gard), whose influence it was expected would suffice for procuring him a benefice. In this last particular they were disappointed; and at the end of about two years, during which Racine had been vainly endeavouring to study theology, he returned to Paris and the world. In 1663 he was presented at court, and about the same time made the acquaintance of Boileau and Molière, and began to write for the stage. His first tragedy, the Thébaïde, or Les frères ennemis, was first performed by Molière's troupe at the Palais-Royal in 1664, as was also his next, Alexandre, in 1665. But the fact of his devoting himself to the drama did not deprive him of all chance of ecclesiastical preferment, for in 1667 he received the priory of Espinay, and afterwards the livings of Saint-Jacques de la Ferté and Saint-Nicolas de Chésy. The drama, however, continued for many years to be his sole serious occupation. His first two tragedies were merely tentative pieces, containing but few indications of the author's dramatic genius. His first master-piece was Andromaque, which on its performance in 1667 produced a profound impression and excited well-merited admiration. It was brought out at the Hôtel de Bourgogne, Racine having in the meantime quarrelled with Molière. The subsequent works of Racine are all master-pieces. The immediate successor of Andromaque was a comedy (Racine's only extant comedy), Les Plaideurs, a witty and delightful imitation of the Wasps of Aristophanes. It appeared in 1668, and was at first rather coldly received, being indeed saved only by the laughter of the king. His next pieces were Britannicus (1669); Bérénice (1670), composed at the request of Henrietta of England, who had also invited Corneille to write a drama on the same subject; Bajazet (1672); Mithridate (1673); Iphigénie (1674), considered by Voltaire the greatest work that the French stage has produced; Phèdre (1677), the last piece that Racine produced expressly for the theatre. Little is known of the private life of Racine during this period, almost all his correspondence having been lost or rather burned from a too pious respect for his memory. Hitherto he was unmarried, but for several years (from 1670) he kept up a *liaison* with an actress named Champmeslé, whose performance of the part of Hermione in Andromaque he had witnessed with rapture. In 1673 he obtained a seat in the French Academy. In 1675 he was nominated by Colbert a royal councillor and treasurer of France for the general government of Moulins (Bourbonnais), but he never entered on the duties of his office. His withdrawal from the theatre in 1677 was partly due to chagrin at the success of a hostile party of theatrical critics who set up for being fine wits, and applauded one Pradon, a writer now never heard of, at the expense of Racine; and partly to feelings of remorse for his past life, heightened no doubt by reminiscences of his early education, which induced him to think of becoming a Carthusian monk. From this purpose he was turned by his friends, who persuaded him to marry. Soon after (1678) he was appointed, along with Boileau, historiographer to the king, whom he accompanied in his campaign to Flanders. After a silence of twelve years Racine, at the solicitation of Madame de Maintenon, added two other pieces to the list of his dramatic works—Esther (1689) and Athalie (1691), the latter of which is often spoken of by French critics as the most perfect of his works. They were both intended for the pupils of Saint-Cyr, the institution founded by Madame de Maintenon. The death of Racine is said to have been hastened by grief at losing the favour of the king. He was buried at his own desire at Port-Royal, at the foot of the grave of one of his former masters, M. Hamon. After the destruction of the abbey of Port-Royal in 1709 his remains were removed to Paris, and deposited in the church of St. Étienne-du-Mont. As a dramatist Racine is usually considered the model of the classical or national tragic drama of the French, and in estimating his powers in this field it is necessary for the critic to take into account the stiff conventional restraints to which that drama is subjected. What Racine achieved within these limits is extraordinary. It has been objected to him that he has introduced too much love into his pieces, and that he has represented his tragic princesses and heroines too susceptible of the passion. To this he was led partly by his own disposition, and partly by the character of his age. He wrote as a Frenchman and for Frenchmen of the old type, in whom heroism and gallantry were combined; and no other French poet has succeeded in depicting with so much truth and tenderness, and expressing in such harmonious and beautiful verses, the feelings of a delicate and high-minded chivalry, and of a pure and ardent love. Besides his dramas Racine is the author of a number of stinging epigrams, some odes and hymns, an abridgment of the history of Port-Royal, letters, and some historical fragments on the campaigns of Louis XIV. Among his letters are two written in reply to a work of Nicole of the Port-Royal, entitled Les Visionnaires (1666), in which the author bitterly denounces poets and still more dramatic writers. The tone of these letters is severely sarcastic, and naturally caused great offence to his old friends and masters. Only one of the letters was published at the time they were written. Boileau having pointed out to Racine that he was only holding up to ridicule a number of excellent men, who were already persecuted by the Jesuits, the latter good-naturedly suppressed the second letter, which accordingly did not appear till after his death. After his retirement from the theatre Racine found it easy to reconcile himself with his old friends. Among the editions of the Œuvres poétiques of Racine one of the best is that published at Paris in three volumes between 1801 and 1805, which is regarded as a marvel of typography. An excellent edition of the Œuvres complètes of Racine was published in eight vols. octavo between 1865–73 in Hachette's collection of the Grands écrivains de la France. It is preceded by an admirable essay on Racine and his time by Paul Mesnard. Another careful edition is that of Lemerre (1875, five vols. 16mo).

RACING. See HORSE-RACING.

RACK. See TORTURE.

RACKETS, or RACQUETS, a game played in a prepared court, open or close, with a small hard ball

and a kind of bat. The bat is about 2 feet in length, about two-thirds of which forms the shaft or handle, the remainder being an oval frame on which is tightly stretched a net-work of cat-gut. The part of the shaft by which the bat is held is covered with leather and ribbed, to enable the player to grasp it firmly. It is from this bat and the net-work, which is its principal feature, that the game derives its name (Italian, *racchetta*, for *retichetta*, an old diminutive of *rete*, Latin and Italian, a net; French, *raquette*). The close, that is, roofed court, is now generally preferred for playing in. It is an oblong rectangular space, and when of full dimensions is 80 feet long, 40 feet broad, and has walls 40 feet high. The players stand facing one of the narrow walls, which is called the front wall. The opposite one is the back wall, which, at the height of 14 feet from the ground, is broken by a gallery intended for the umpire, marker, and spectators. The walls are covered with some fine cement fitted to give a perfectly smooth and hard surface. In this country they are usually painted black, the balls used being white. In India it is the reverse. The best material for the floor is asphalt, and the players wear gutta-percha shoes, to prevent them from slipping and from injuring the floor. The lighting of the court should be from above, and the windows ought to be protected by a wire netting. The door of the court is in the back wall; it is made of some hard wood, and ought to fit the opening with great nicety, and when shut to be perfectly flush with the surface of the wall. The floor is divided in the first place by a line called the short line drawn breadthways across it at the distance of two-fifths of the length of the court (in a court of the dimensions above stated, 32 feet) from the back wall. The smaller area thus formed, that bounded on one side by the back wall, is subdivided into two areas of equal size by a line drawn from the middle of the back wall to the short line, parallel to the side walls. These are called respectively the right and the left hand corners, the former being that on the right hand of a person looking to the front wall. In the area on the other side of the short line two still smaller areas are marked off in the corners contiguous to that line. These are called the service spaces, and are formed by drawing a line of 6 feet 6 inches in length from each of the side walls parallel to the other two walls at a distance of 8 feet 6 inches from the short line, and then from the extremity of each of these lines another line parallel to the side walls and extending to the short line. Two horizontal lines are drawn across the front wall, one 2 feet 2 inches, and the other, the cut line, 7 feet 9 inches above the floor. The surface between the floor and the lower of these lines is covered with wood, which serves as a sounding-board to enable the players to know when it is struck by the ball.

The game may be played either single or double, that is, with either one or two persons on each side. It is decided by lot which side goes in first, and when there is only one player on each side the first player assumes which side of the court he pleases (usually the right), while the other stands in the opposite corner. The first player then begins to *serve*, in doing which he must have one foot in the service space of his side. Serving consists in striking the ball with the bat so as to make it strike the front wall above the cut line without previously striking any other part of the court, and then rebound into the opposite corner beyond the short line. In rebounding from the front wall it does not matter whether the ball strikes either of the side walls or not before it lights on the floor in the opposite corner of the court. If the ball is properly served the second player must strike it before it has made a second bound, so that it strikes the front wall above the board; but in returning the ball in this manner the player may if he likes first make it strike either of the side walls. The player to whom a ball is served does not require to wait till the ball has bounded from the floor before he returns it. He may if he likes return it before it touches the floor. Such a stroke is called a volley. The ball being thus returned by the second player, the first player returns the ball in the same way, and this goes on until either player fails, which may happen in three ways, either by the ball being made to hit the sounding-board, or being struck into the roof or gallery, or later than the first bound. If it is the first player who fails, his hand is out, and it is then the turn of the second player to serve. If it is the second player, then the first scores one (an ace), and the first continues to serve, but goes to the opposite side of the court. The server's hand is also put out in serving if he causes the ball to strike any other part of the court before it strikes the front wall; if the ball strikes the server (or in four-handed rackets his partner) before bounding twice; or if the server makes two successive faults in the other conditions of serving, namely, that the ball should strike above the cut line and rebound so as to fall in the opposite corner beyond the short line. It is, however, open to the second player to take a ball improperly served in these last two particulars if he pleases, and in case of his doing so the ace must be played out. In general fifteen is game. When there are two players on each side the server and the one to whom he serves stand at the commencement of the game or a service as in single rackets, and the other two players stand in a line behind the server, the latter's partner being next the back wall. The order in which the players serve is, first, one who belongs to the side that gains the lot; then when he is put out one of the enemy, next the enemy's partner, and lastly the first server's partner. The reason of this arrangement is that the side going in first has the chance of scoring first-blood. The other details of the game must be derived from the rules drawn up by the different racket clubs. (Supplement to the English Cyclopædia.)

RACOON or RACCOON (*Procyon*), a genus of Carnivorous Mammalia, included in the Plantigrade (which see) section of the order and in the Ursidæ or Bear family. The members of this genus possess six incisors, two canines, eight premolars, and four molars in each jaw, and the group is well exemplified in the Common Racoon (*Procyon lotor*) of North America, which derives its specific name of *lotor* ('a washer') from its habit of washing its prey before eating it, or of holding the food in the fore paws and shaking it violently backwards and forwards in the water so as to moisten and saturate it as thoroughly as possible. In size the racoon, or *mapach*, as it is sometimes termed, averages a fox, and in outward appearance and form somewhat resembles that animal. The general body-colour is a sooty or blackish-gray, and the fur consists of a close set of under hairs, with larger outer hairs, the latter being marked black and white. The upper part of the head and the portion across the eyes are coloured dark brown; and the fur across the knee-joints presents darker colours than the rest of the body. The tail is short and bushy; it is coloured dark gray, and marked by five or six black rings. Very rarely the fur of this animal may be developed of a pure white colour. These animals, although typically carnivorous, yet seem to feed largely upon, and indeed to prefer, vegetable matters. The diet is omnivorous in fact; but in its native state it appears to subsist

upon molluscs, crabs, and marine animals, and, as already remarked, it is fond of moisture and water. The German name, *Wasch-Bär*, or 'Washing-Bear,' is given to the racoon for the same reason as that indicated by the specific name *lotor*. These animals appear to be chiefly nocturnal in habits, and pass the day in sleep. They are readily tamed, and may become very familiar, and whilst under domestication may drink alcoholic stimulants and liquors to a large extent. The racoons are greatly hunted in North America by means of dogs, which force the animal to take refuge in a tree, whence it is dislodged by climbing. And the subtlety and cunning displayed by these animals in their endeavours to escape have become quite proverbial—expressions such as a 'sly 'coon,' 'wake as a 'coon,' indicating these qualities, analogous, indeed, to those displayed by our own fox. The young are born generally in May, and number two or three at a birth. (See Pl. XXXIII.-XXXIV. fig. 9.)

The Agoura or Crab-eating Racoon (*P. cancrivorus*) is found further south on the American continent than the above species. It is generally larger than the Common Racoon, the tail being shorter, of a grayish yellow tint, and marked with six black rings. The fur is blackish gray, tinted with yellow colour, and of variable lights and shades over the different regions of the body. The eyes are surrounded by dark brown patches, which run into the ears, and terminate in a patch on the top of the head. Although denominated the 'Crab-eating' Racoon (and thus resembling the opossum—which see—of that name), this form does not appear to be specially addicted to a crustacean dietary, in any greater degree at least, than the common species. The Wah or Pandah (*Ailurus fulgens*) of India appears to represent in that country the American racoons; the Wah belonging to the same family as the latter forms.

RADCLIFFE, Ann, a novelist of some reputation, was born in London in 1764. Her maiden name was Ward. She married at the age of twenty-three Mr. William Radcliffe, a student of law, and afterwards editor and proprietor of the English Chronicle newspaper. Her first novel, published in 1789, was the Castles of Athlin and Dunbayne, a Highland story. It had little success, but perhaps as much as it deserved. The Sicilian romance, published in 1790, is superior to the former, and the Romance of the Forest (1791) is a still farther advance. Her master-piece is considered to be the Mysteries of Udolpho (1794), which was long very popular, though seldom to be seen now-a-days. The last of her novels published during her life was the Italian (1797). A posthumous romance, Gaston de Blondeville, was edited by T. N. Talfourd in 1826, together with some poetical pieces. Another work of hers was a Journey through Holland, &c. She died in London in 1823. Mrs. Radcliffe's novels were at one time very popular, and to a certain extent they deserved it. She had a considerable power in the description of scenery, and knew how to excite and maintain the curiosity of her readers, 'harrowing up the soul with imaginary horrors, and making the flesh creep and the nerves thrill with fond hopes and fears;' but her characters are utterly insipid, the world in which they move is utterly unreal, and the conclusion of her stories, when all the wondrous effects are found to have been brought about by simple and even puerile means, is lame and impotent in the highest degree.

RADCLIFFE, John, a celebrated medical practitioner, born in 1650 at Wakefield, in Yorkshire. He was educated at the University of Oxford, where he took his degree of M.A. in 1672. Having studied medicine, and taken the degree of M.B. in 1675, he began to practise at Oxford, where he continued up till 1684. He then removed to London, and soon became very popular in his profession. In 1686 he became physician to the Princess Anne of Denmark, and he was frequently consulted by King William after his accession. This patronage naturally secured him a lucrative practice among the nobility and upper ranks of society. He attended Queen Mary in 1694 when she was attacked by the small-pox, but was unable to save her. He was rather rough and blunt in his manners, and lost the good graces of Anne, and also of King William, by his plain-speaking. In 1714, when the queen was seized with her last illness, he was sent for, but either could not, being ill himself, or would not come. This gave rise to great ill-feeling towards him. He died Nov. 1, 1714. Dr. Radcliffe left £40,000 to the University of Oxford for the foundation of a public library of medical and philosophical sciences. See next article.

RADCLIFFE LIBRARY, a library founded in connection with Oxford University out of funds destined for the purpose by Dr. John Radcliffe. It was formally opened on the 13th of April, 1749. The works belonging to it are chiefly in the natural sciences and medicine. Those referring to natural science have been transferred to the library of the university museum. The building erected by the Radcliffe trustees for the reception of the books forming the library is now used as a reading-room in connection with the Bodleian Library. It was designed by Gibbs, and is circular in form, and surmounted by a high dome. The remainder of the funds bequeathed by Dr. Radcliffe is still in the hands of trustees, who grant a yearly allowance of £500 for the sake of making additions to the collection. Between 1758 and 1760 a valuable body of oriental MSS. was acquired by the trustees of the library from the Frazer and Sale collections. Among these A. W. von Schlegel discovered a Sanskrit MS. which he described as 'unique in Sanskrit literature,' bearing the date 1405–7, sixty-five years earlier than that of the most Ancient MS. at Paris. It contains almost all the poem Sri Bhâgavata Purâna.

RADCLIFFE OBSERVATORY, an observatory at Oxford in connection with the university, founded in 1772 by the Radcliffe trustees.

RADETZKY, Joseph Wenceslaus, Count, an Austrian field-marshal, was born on the 2d January, 1766, at Trebnitz, in Bohemia, joined a Hungarian regiment of horse in 1784, took part in the campaigns of 1788–89 against the Turks, and of 1792–95 in the Low Countries and on the Rhine. In 1796 he was appointed major-commandant of the corps of pioneers, and in 1799 attained the rank of colonel. In 1800 he received the command of Archduke Albert's regiment of cuirassiers, and in this capacity distinguished himself greatly at the battle of Hohenlinden. On the recommencement of hostilities, after the peace, he proceeded as major-general to Italy, where, under Davidovich, he performed signal services. During the campaign of 1809 he became lieutenant field-marshal, and served at the battle of Wagram, where, as also in the retreat of the Austrian army, he displayed distinguished merit. After the Peace of Schönbrünn he was made chief of the quartermaster-general's staff, and a member of the state council-of-war, in which he set himself actively to work in reorganizing the Austrian army. On the final rupture of Austria with France he again took the field, and was wounded at the battle of Leipzig. In 1821 he received the appointment of commander of the fortress of Olmütz. The commotions in Italy following the French revolution of 1830 called him to that country, where a great part of his subsequent life

was spent. In 1836 he was created field-marshal. On the breaking out of the insurrection at Milan on the 18th March, 1848, he maintained a fight for several days in the streets, and then retreated with his forces to Verona. On the Sardinian king Charles Albert taking the field Radetzky assumed the offensive, advanced to Mantua, crossed the Mincio, took the lines of Curtatone, and marched up the river. The insufficiency of the force at his command compelled him to fall back on Mantua, while Peschiera and the heights of Rivoli fell into the hands of the enemy, who effected their passage across the Adige. The situation of Radetzky was for the moment extremely critical, but by taking the heights of Sona and Sommacampagna, and occupying those of Custozza, he obstructed the advance of the Sardinians across the Mincio. He was now in a position to offer battle, and gained on the 25th July the victory of Custozza, which compelled Charles Albert to retreat to Milan, and then evacuate the city after a short contest. Through his energetic talents Radetzky thus preserved Lombardy to Austria. An armistice having been concluded with Sardinia he next occupied himself with the blockade of the revolted city of Venice, but hurried from it in March, 1849, on the resumption of hostilities with Charles Albert. He assembled his army at Pavia, crossed the Ticino, and after the preliminary successes at Vigevano and Mortara gained so decided a victory over the Piedmontese army at Novara, on 23d March, that their king abdicated in favour of his son Victor Emmanuel, and a treaty was concluded which secured for the present the Austrian supremacy in Italy. Venice surrendered to Radetzky in August of the same year. His energies were then devoted to consolidating and strengthening the Austrian power in North Italy, an undertaking in which his vigour and ability were eminently displayed. Honours and rewards of all kinds were now showered upon him. He took up his residence at Milan, and died there on the 5th January, 1858.

RADIATA, one of Cuvier's four great sub-kingdoms or divisions of the animal kingdom, the other four being the Articulata (or Annulosa), Mollusca, and Vertebrata. The Radiate animals, according to Cuvier, characterized in chief by their round or radial symmetry, included all the Protozoa (which see) and such forms as are now termed Cœlenterata (Hydræ, Zoophytes, Sea-anemones, Corals, &c.), together with the Star-fishes, Sea-urchins, Sea-cucumbers, Tape-worms, &c., now included in the sub-kingdom Echinozoa or Annuloida. In addition to these groups the Molluscan class Polyzoa (which see) was erroneously included by Cuvier in his Radiate group.

In modern zoology, and as the structure or morphology of animal forms came to be better understood, it was seen that Cuvier's great Radiate group must be divided into several other divisions, since the included radiate forms in many respects were found to be of very dissimilar kinds, and such as could not naturally or reasonably be allowed to appear related in the system of classification. Accordingly the Protozoa were first distinctly separated out from the Radiata to form a sub-kingdom of themselves. And in due time the group of Cœlenterate animals was founded by Frey and Leuckhart to include those forms which possess an imperfectly specialized digestive system, whilst the Echinozoa or Annuloida similarly absorbed the Star-fishes, their allies, and the Scolecida or Tape-worms, &c.

The Echinozoa, perhaps, of the three groups into which the Cuvierian Radiata have been divided present the least satisfactory appearance when regarded according to morphological laws and in relation to the clear structural affinities of its included forms. Indeed by some naturalists the group Echinozoa is regarded as a 'refuge for the destitute' in that the animals included in this sub-kingdom are so diversified and dissimilar. But to this observation we might reply that 'refuges for the destitute' are very necessary and useful institutions in zoological classification; and that if the animals included in the Echinozoa (with the exception of the class Echinodermata) are dissimilar, then the sub-kingdom has its use and value as bringing together animals which would not be at home in any of the other sub-kingdoms of the animal world. And we might further maintain that the Echinozoa are related by certain characters, which, if not of very prominent kind, are yet not more indefinite than are possessed by some groups in other sub-kingdoms. In any case, therefore, we are justified in recognizing the Echinozoa either as a division of itself or as a branch of Annulosa until at least some naturalist proposes a better or more reliable scheme for the classification of these forms.

RADIATION, one way in which a body gives out heat. Heat may either be radiated or conducted. When we feel the heat of the sun or the heat of a fire we are made sensible of radiant heat. The sensations produced when we take hold of a hot poker or a frosty pump handle are due to the conduction of heat. In liquids and gases heat is said to be carried from one part of the liquid or gas to another by convection, but convection is, when properly considered, simply conduction.

The phenomena of radiant heat are identical with those of light, and the same hypothesis as to origin and mode of propagation will serve for both light and heat. (See UNDULATORY THEORY.) In the solar spectrum we find that the violet portion has a very small heating value, and that the heating power is most intense some distance below the red, where the spectrum is invisible. If we consider the effects of a pencil of rays as it comes from the sun, they are resultant effects of a great number of sets of vibrations in the supposed ether, which sets of vibrations do not naturally interfere with one another, and each set may be conceived of as acting independently of all the others. The velocity of approach being the same, and the number of vibrations per second being different, the wave-lengths will be different, and the different physical effects are due solely to differences of wave-length of the several sets of rays.

When a pencil of the sun's rays traverses a glass prism, entering the glass from air, the sets of rays are more bent towards the perpendicular to the surface of the prism as their wave-length is smaller; and the same will be true when the prism is made of other substances, such as rock-salt, which are denser than air, so that we may call rays of shorter wave-length rays of greater refrangibility, and rays of longer wave-length rays of less refrangibility. This difference of bending enables us by means of prisms of different materials to separate a pencil of rays into its component sets, and we can examine these separately when they are spread out into what is called a spectrum.

If a photographic plate be exposed in the solar spectrum we obtain a picture of the chemical effects on salts of silver, for the plate, on being developed, will have silver deposited most thickly where the chemical action was greatest. Our eye can judge of the part of the spectrum which is brightest, and by means of a linear thermo-multiplier we can lay down a curve exhibiting the heat intensity in moving from one end of the spectrum to the other. It will be seen that the maximum of chemical action is produced by sets of rays which vibrate more quickly than those which give the maximum of light, and

these again have a shorter wave-length than the sets of rays which have the greatest heating effect. For reasons to be given below, in order to get accurate results in the above experiment the material of which the prism is composed should be different when we examine for light or chemical action from that of the prism which is used when we examine for heat. It is found that in order to lay the simple sets of rays beside one another, and with as little overlapping as possible, the beam of light should come from a narrow slit, and the purity of our spectrum will depend on the thinness and perfection of the beam of light incident on the prism. See SPECTRUM.

No substance is perfectly diathermic, that is, every substance through which heat is radiated absorbs some of the heat. When a simple set of rays, that is a set of rays having all the same wave-length, is radiated through a medium, if we suppose the medium split into thin equal films the fraction of the total quantity of heat entering any film which is absorbed by that film is constant for all the films, but different substances have a difference of choice as to the rate of absorption for rays of different refrangibility. Some vibrations in a mixed beam will be absorbed at once, and the rate of absorption of the remainder may be so slow that after the beam has passed through a thin plate of the substance, passing it through additional thicknesses will not appreciably affect it. The beam in this case is said to have been sifted by the first plate. Dry air absorbs very few of the sun's rays, but the experiments of Dr. Tyndall on moist air show that a damp atmosphere has a powerful influence on the heating effects of the sun. The heat of the sun has been sifted in passing through the atmosphere, and when it reaches us appears to pass through air without any loss. In saying of a body that it is more or less diathermic we should specify the source of heat with which we have experimented. Common glass allows most of the sun's heat to pass freely, but it will intercept most of the heat from a fire. In the case of a green-house the sun's rays pass freely through the glass, and are converted to rays of less refrangibility against the floor walls, &c., and the glass will not permit this heat to be radiated through it, so that the inside of the hot-house is maintained at a high temperature. When a body intercepts radiant heat it becomes heated, and those vibrations which it absorbs are the vibrations which it will produce when radiating as a heated body. This in the case of light is the foundation of all spectral analysis. By means of the vibrations absorbed or produced by the different chemical elements these elements are detected in their compounds. Bodies which absorb all or nearly all the heat vibrations from a given source are said to be adiathermic to that kind of heat.

It has hitherto been impossible to determine the velocity of invisible heat rays, but those rays which give both light and heat effects have a velocity of about 190,000 miles per second, and it is all but certain that this is also the velocity of obscure heat.

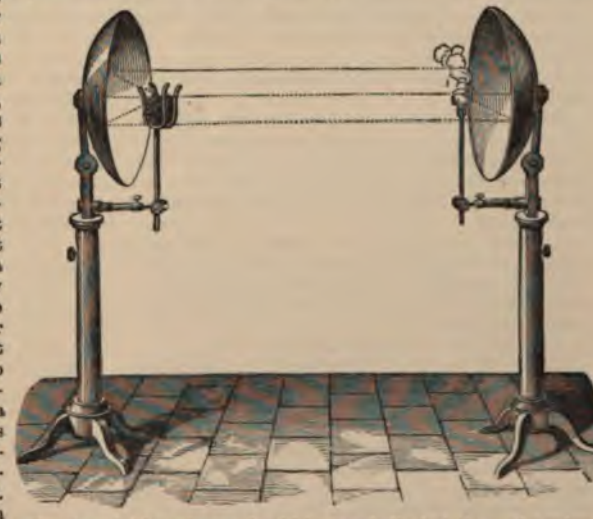
When heat is radiated through a medium which does not absorb it, the intensity at any point is inversely proportional to the square of the distance of that point from the heated body.

All bodies radiate heat continuously, and at the same time absorb heat which is being radiated from surrounding bodies, so that there is a constant tendency to arrive at equality of temperature. Newton's law of cooling states that *the rate at which a body loses heat is proportional to the difference between the temperature of its surface and that of the inclosure.* It is found, however, that this law is not exactly followed, and the experiments of MM. Dulong and Petit on the velocity of cooling of a thermometer in vacuo show that for great variations of temperature the law is not nearly true. They found that when the body was 200° C. in excess of the inclosure the rate of cooling was 7·40° C. per minute, but at 100° C. the rate was 2·30° C. per minute, and not 3·70° C., as Newton's law would suppose it to be.

Newton's law is a useful approximation when the excess of temperature does not exceed a few degrees.

The theory which supposes a constant interchange of heat among bodies by radiation was called by Prevost, its author, *the theory of movable equilibrium of temperature.* According to this theory a body which remains at constant temperature just radiates as much heat to surrounding bodies as it receives from these bodies. A body rises in temperature when it absorbs more than it radiates, and it falls in temperature when it radiates more than it absorbs. This subject has been very completely investigated by Professor Balfour Stewart and others, and very important results have been obtained. See HEAT, RADIATION OF.

Dark heat may be reflected, and follows the laws of reflection of light. Two mirrors of polished brass



(the mirrors should be parabolic, but those of a spherical form are easier to manufacture, and will answer all practical purposes) are placed with their axes in the same straight line in the position shown in the figure, and at any convenient distance apart. An iron ball heated to dull redness is placed in one focus and a piece of phosphorus in the other. The course of the rays of heat is indicated by dotted lines, and if in performing the experiment the foci have been accurately determined the piece of phosphorus will be ignited by the heat radiated from the hot ball and reflected by the mirrors.

Professor Forbes has experimentally demonstrated that all kinds of heat may be polarized as light is polarized. He used two plates of tourmaline cut parallel to the axis of the crystal, and he found that most of the heat was absorbed when the position of the plates was such that the axes of the crystals were

at right angles to one another. He also used plates of mica split by heat for his experiments on polarization by refraction and reflection. He found that the mica plates, although nearly opaque to light, allowed a large portion of heat to pass, and if the rays make a proper angle with the surface those which pass through are considerably polarized. These may be analyzed by a second plate of mica, and it is found that giving this second plate the same inclination as the first, and turning it round, as in the case of the similar instrument for light (see POLARIZED LIGHT), the maximum transmission of rays through the apparatus occurs when the plates of mica are parallel, and the minimum when the movable plate has been turned through a right angle.

Professor Forbes proved the circular polarization and depolarization of heat, and the turning of the plane of polarization by solutions of sugar and other substances has also been demonstrated.

Experiments on radiant heat have been very much facilitated by the thermo-multiplier (see THERMO-ELECTRICITY), but even with this instrument heat indications are given slowly compared with the quickness by which the eye judges of the presence or absence of light.

RADICLES, a name given in chemistry to certain groups of elements which remain united throughout many reactions. Radicles are sometimes known in the free state; thus the group called cyanogen (CN) is a well-known gas; it also enters into the formation of a large number of compounds. On the other hand, there are many radicles which have never been isolated; thus the group ammonium (NH_4) is only known in combination with other elements. See CHEMISTRY.

RADIOLARIA. See POLYCYSTINA and PROTOZOA.

RADISH (*Raphanus sativus;* natural order, Cruciferæ), a well-known esculent root, universally cultivated in temperate climates, and used as a salad, &c. The plant was originally brought from China and Persia, but has been cultivated in Europe from time immemorial.

RADISH, OIL OF. The roots and seeds of radish yield, by distillation with water, a milky liquid, from which an essential oil may be prepared by rectification, which is colourless, heavier than water, and contains sulphur.

RADIUS, in geometry. See DIAMETER.

RADIUS, the bone of the fore limb of vertebrate animals, which, as in man, when the arm is supinated or laid flat, with the palm upwards, lies to the thumb side of the limb. This side is therefore termed the *radial* side of the limb, in contradistinction to the *ulnar* or opposite side, so named from the ulna or neighbouring bone, which, with the radius, constitutes the fore-arm. In man the radius is a long, cylindrical bone, bearing a *neck* and rounded *head* at its upper portion, the head articulating with the *ulna* and by a synovial joint with the *humerus* or bone of the upper arm. It is broadened at its lower (wrist or *carpal*) extremity, and its posterior surface is grooved for the reception and passage of the tendons of muscles. At the carpal extremity it articulates with the ulna. The upper end of the radius turns, in the motions of the fore-arm, on the double surface afforded by the pivot surface of the humerus and the slightly cup-like depression of the ulna. At its lower end the radius rotates round the lower end of the ulna. In the action of *supination*, as above defined, the radius lies parallel with the ulna, the lower extremity of the radius lying to the outer side of the neighbouring bone. In *pronation*, where the palm is turned downwards, the radius turns above on its own axis and around the ulna below, and crossing the latter bone—as when the hand and arm hang downwards with the palm turned backwards.

The radius is always represented in the forearm of Vertebrates above fishes, in which latter forms it is difficult or impossible satisfactorily to determine its representative. In birds, however, in which movements of pronation and supination would render the fore limbs inefficient as wings, the radius is much smaller than the ulna, and is subordinate in its development to that bone. It is very short and flat in Cetaceans, and is ossified in Sirenia at each end to the ulna. In the Frog and Camel the radius is apparently the sole representative of the bones of the fore-arm; and in Bats and Ruminants generally it forms the almost sole support of the fore-arm. In the dog, elephant, and Ungulates generally, the normal position of the radius is a crossed position with regard to the ulna, as seen in pronation in man. In Apes, Sloths, &c., movements of pronation and supination are also performed.

RADIUS VECTOR. A point in space is specified if we know its distance from a fixed point and the angles which its direction from this point makes with two fixed directions. We may suppose any curve whatever as being traced by one extremity of a straight line whose other extremity is fixed and whose length and direction vary; such a line is at any instant the radius vector of the point of the curve which it is tracing at that instant.

In the case of a circle, when the centre is chosen as the fixed point or origin, the radius vector is of constant length, and the length of the curve between any two points measures the angle turned through in describing that curve, but if any other point is chosen for origin the radii vectores for different points will not be equal. When a point is specified by the length and direction of its radius vector it is said to be given in polar co-ordinates. In treating questions of analytical geometry by the method of polar co-ordinates the origin (as instanced above in the case of the circle) may be often chosen so as to simplify the problem, and the character of the question may be such that it is more easily dealt with by the polar method than by the Cartesian method. This is notably the case in dealing with questions as to the paths of bodies acted on by central forces. The earth moves in an orbit which is approximately an ellipse, in one focus of which the sun is situated. The earth's path is conceived of as having been traced by the extremity of a right line of variable length revolving about the sun's centre, which is taken as a fixed point, and in astronomy the radius vector of any point of an orbit is the line from that point to the centre of force round which the orbit is described. See MATHEMATICS—Polar Co-ordinates.

RADNOR, or RADNORSHIRE, an inland county in South Wales, bounded north by Montgomeryshire and Shropshire, east and south-east by Herefordshire, south and south-west by Brecknockshire, and west by Cardiganshire. The area is 276,552 acres, of which in 1883 156,558 acres were under cultivation. The surface throughout is hilly, in some parts approaching to mountainous, the highest summit of the Forest of Radnor reaching an elevation of 2163 feet above sea-level. The principal portion of Radnorshire is composed of the strata forming the Silurian system, but on the west and north-west side of the county the upper beds of the older rocks, composing the Cambrian system, make their appearance. Syenite and porphyry occur in many parts; and a coarse amygdaloidal trap is met with. There are several medicinal mineral springs, some of which are in good repute. Oats and wheat are the principal crops. But the chief dependence of the farmer is on the stock reared on the pasture-land and com-

mon-land, which not only support large numbers of sheep, but, in the more sheltered parts, cattle of all sorts. The cows are principally of the Herefordshire breed. The draught-horse in general use is rather small, but capable of enduring great fatigue. The original Welsh ponies are still bred in the mountains. Large quantities of butter are made. The ancient forests of Radnorshire, which were of great extent, have long since disappeared. The manufactures are trifling. The chief manufacture is flannel. None of the rivers are navigable. The county returns one member to Parliament, and one is returned for New Radnor in conjunction with other places. Pop. (1881), 23,528.

RADNOR, NEW, a parliamentary borough and small market town in South Wales, in the county of Radnor. The town, on a plain in the Vale of Radnor, 60 miles N.N.W. of Bristol, and 3½ miles north-west of the village of Old Radnor, has a population of only about 500. The borough is an agricultural district, with a circumference of about 30 miles, and a population of 2190. The boroughs that unite with it in returning a member to Parliament are Cefnllys, Knighton, Knucklas, Presteigne, and Rhayader.

RADOM, a government in Russian Poland, formed in 1845, and confined to its present limits in 1867. It is bounded on the north by the government of Warsaw, on the north-east by that of Siedletz, on the east by that of Liublin, and by Galicia and the government of Kieletz on the south; area, 4758 square miles. The soil is generally fertile, but rather stony in the southern parts. The meadows, which cover an area of nearly 300 square miles, produce about 70,000 tons of hay annually. The corn crops grown are wheat, rye, barley, buckwheat, and hay. The principal manufactures are woollens, leather, and oil. There is also a considerable number of breweries. Pop. (1880), 624,070.

RADOM, a town in Russian Poland, on the Radomka, 85 miles south of Warsaw, capital of the government of the same name. It has a church and convent belonging to the fifteenth century; manufactures of tin, oil, vinegar, and leather; and two annual fairs. Pop. (1880), 12,061.

RADZIWILL, the name of an ancient family, one of the most famous in Poland, and originally descended from Narimund, grand-duke of Lithuania. Among its most distinguished members are:—1. NICOLAS the Black, son of John the Bearded, and palatine of Wilna. King Sigismund Augustus, who owed much to his services, held him in the highest esteem, and gave him the command, in 1552, in the war of the Poles against the Polish knights. He also commanded in the war against Russia in 1561. When ambassador to the court of Charles V. he gave due attention to the interests of his country, and having become a convert to the Reformation, zealously espoused its cause, and showed his enlightened interest in it by procuring a translation of the Bible into the Polish tongue. He died in 1567, leaving several sons, who, instead of walking in his steps, went back to Popery. George, archbishop of Cracow, bishop of Wilna, and a cardinal, was the most zealous and most bigoted among them.—2. CHRISTOPHER II., of a different line, military governor of Lithuania and palatine of Wilna, belonging to the Protestant Church, was the enemy of King Sigismund III., who, after promising him several crown appointments, had bestowed them on Sapieha. In the same way as in Germany during the Thirty Years' war the Protestants were oppressed during the government of Sigismund. C. Radziwill, after the death of Sigismund, in 1632, undertook their defence at the Diet of Warsaw, and with such success that he obtained complete toleration for them. Enjoying the confidence of Wladislaw IV. he commanded in the war against Russia, and rendered important service to his king and country. He died in 1640.—3. BOGUSLAW, Prince Radziwill, son of Prince James and Sophie Elizabeth, margravine of Brandenburg, was governor in Prussia, 1657–69, and rendered important services to it both by his administration and endowments to universities and schools. —4. CHARLES, Prince Radziwill, palatine of Wilna and grand-commander of Lithuania, possessed of an income of 1,300,000 dollars. In his own and his country's service he maintained 6000 soldiers at his own expense; and fully aware that nothing good to Poland could come from Russia, he was the enemy of Czartoryski and the Russians, and an adherent of the Saxon party. He was an ardent supporter of the confederation of Bar, and was several times obliged to exile himself. He spent the periods of his exile in Turkey, Italy, Germany, and France. For three years he took part in the labours of the constituent diet at Warsaw, but died in 1790, before the new constitution was completely drawn up and promulgated (May 3, 1791).

RAEBURN, SIR HENRY, a very eminent portrait-painter, was born at Stockbridge, near Edinburgh, March 4, 1756. At the age of fifteen he was bound apprentice to a goldsmith in Edinburgh. On the expiration of his apprenticeship he became professionally a portrait-painter; and with the view of improving in his art he repaired to London, and afterwards spent two years in Italy, diligently engaged in studying the great masters; he returned in 1787, and established himself in Edinburgh. Here he soon rose to the head of his profession in Scotland—an eminence which no artist presumed to dispute with him during the remainder of his life. The most interesting of his works are a series of half-length portraits of his literary and scientific friends, which he painted solely for his own private gratification. In 1822, when King George IV. visited Scotland, Raeburn was knighted, and appointed portrait-painter to his majesty for Scotland. He did not long survive those honours, as he died in 1823.

RAFFLE, a game of chance, in which several persons each deposit part of the value of a thing for the chance of gaining it.

RAFFLES, SIR THOMAS STAMFORD, a distinguished naturalist, the son of a captain in the West India trade, was born at sea, off Jamaica, in 1781. In 1810 he was appointed agent of the governor-general to the Malay states; and the following year, on the reduction of Java by the British, he was nominated lieutenant-governor of the island. In this capacity he continued till the island was given up to the Dutch in 1816, when he returned to England with an extensive collection of the productions, costumes, &c., of the Eastern Archipelago. The year following appeared his History of Java (second edition, 1830). Having been nominated to the lieutenant-governorship of Fort Marlborough, the seat of government of the then British possessions of Bencoolen, in the Island of Sumatra, he went out in 1818 to fill this post. Here he remedied many disgraceful abuses. In 1823 he laid the foundation of a literary institution consisting of a college for the encouragement of Anglo-Chinese literature. In the following year he embarked for Europe; but a fire breaking out in the ship the vessel was destroyed at sea, the crew and passengers saving their lives with difficulty in the boats. He died in 1826.

RAFFLESIA ARNOLDI. This gigantic flower was discovered in the interior of Sumatra. It is parasitic on a species of Cissus. The whole plant seems to consist of little else beyond the flower and root. It is diœcious, and the female flowers are unknown.

The perianth consists of a ventricose tube crowned with a ring, and divided at the summit into five equal lobes. The stamens are very numerous. The stem, which hardly rises above the root, is fleshy, and covered with very large, obtuse, imbricated bracts. The diameter of the flower is 3 feet, and some of its parts are ¾ inch in thickness. It is capable of containing 12 pints of fluid in its cup. The flower is said sometimes to have a weight of 14 lbs. The plant is named after its two discoverers, Sir Thomas Raffles and Dr. Arnold, who came upon it while making an excursion into the interior of Sumatra.

RAFFLESIACEÆ, or PATMAWORTS, a natural order of rhizogens, stemless and stalkless, and consisting merely of hermaphrodite or diœcious flowers, growing immediately from the surface of branches, and immersed among scales. Their principal characteristics are a superior, globose, or campanulate perianth, with five-parted limb; numerous distinct anthers adhering by the base; inferior, one-celled ovary; conical styles as numerous as the placentæ, and run together with the column, but projecting beyond it; and a fruit in the form of an indehiscent pericarp with numberless seeds. The *habitats* of the species are the East Indies, where they grow on the stems of Cissi, and South America, where they grow on the branches of leguminous plants. One of the species, *Rafflesia patma*, is employed in Java as a powerful styptic. *Rafflesia Horsfieldi*, *Rafflesia Cummingi*, *Rafflesia Rochussenii* possess similar properties. The order has been named in honour of Sir Stamford Raffles.

RAFN, KARL CHRISTIAN, a Danish scholar and archæologist, born at Brahesborg, on the Island of Funen, in 1795; died at Copenhagen in 1864. He first studied law, but ultimately devoted himself exclusively to the history and poetry of ancient Scandinavia. In 1821 he was appointed sub-librarian to the University of Copenhagen. In 1825 he was the means of instituting the Archæological Society of the north, the principal object of which was the publication of the hitherto unpublished works of the ancient literature of the northern nations. As secretary of this society he had the editing of all the works that it published. Among the works that he has given to the world are a Danish version of the mythical and romantic sagas of the north; Krákumál, or, The Elegy of the Celebrated Pirate, Ragnar Lodbrog; Fornaldar-Sögur Nordrlanda, a complete collection of the mythico-historical and romantic sagas of the north; the Färeyinga-Saga, in the Icelandic text, with a translation into Danish and the language of the Faröe Islands. In his magnificent work entitled Antiquitates Americanæ (1837) he has proved beyond a doubt that the ancient Scandinavians had discovered America in the tenth century, and between the eleventh and fourteenth centuries had at various times formed settlements along a large extent of coast in North America, principally in Massachusetts and Rhode Island. He was also the author of a large number of valuable memoirs on the interpretation of the Scandinavian runes.

RAFT, a sort of float formed by a body of planks or pieces of timber fastened together side by side so as to be conveyed down rivers, across harbours, &c., more commodiously than if they were separated. The term is also applied in a less technical sense to any rough floating structure, such as those often formed in cases of shipwreck of barrels, planks, &c.

RAFTERS, in building, are pieces of timber, which, standing by pairs on the raising piece, meet in an angle at top, and form the roof of a building.

RAGGED SCHOOLS, institutions supported by voluntary contributions for the education of neglected children and the consequent prevention of juvenile crime. The idea of forming such schools was due to the celebrated Portsmouth cobbler, John Pounds, who about 1819 began to take in the ragged children of the district in which he lived and teach them while he was at work. This he continued till his death in 1839. The success of the plan caused a number of more influential persons to take the matter up, and in 1838 a ragged Sunday-school was opened in London. In 1841 the first feeding-school, in which the children are not only educated but kept and fed for the day, was started by Sheriff Watson in Aberdeen. In 1845 a similar school was opened by Dr. Robertson of New Grayfriars in the Vennel at Edinburgh. But what gave a greater impetus than anything else to the ragged school scheme was Dr. Guthrie's Plea for Ragged Schools, published in 1847. It had an immense circulation, and was followed by the extension of the system to every considerable town in the kingdom. The name ragged schools was first adopted in 1844, when the Ragged School Union was formed. At that time there were twenty schools, with 200 voluntary teachers and about 2000 scholars. There are abundant statistics to show the beneficial nature of the working of ragged schools in places where the system is well organized. At a conference on reformatory and industrial schools held in Edinburgh in May, 1875, Mr. Smith, governor of the Edinburgh prison, stated that when the Original Ragged Industrial School was established in that city (1847) the number of children under fourteen years of age committed to prison was 260, or 5½ per cent. of all those committed, but that since that date the number has gradually grown less, and in 1873 had fallen to 37, or little more than ½ per cent. of all those committed to prison.

RAGLAN, FITZROY JAMES HENRY SOMERSET, LORD, was the youngest son of Henry, fifth Duke of Beaufort, and born on the 30th September, 1788. He entered the army in 1804; was attached in 1807 to the Hon. Sir Arthur Paget's embassy to Turkey; and the same year served on Sir Arthur Wellesley's staff in the expedition to Copenhagen. Subsequent to this he was appointed one of his aides-de-camp by the latter, and afterwards military secretary—an office which he filled through the whole of the Peninsular campaign. He was slightly wounded at the battle of Busaco, and greatly distinguished himself at the capture of Badajoz. In 1814 he acted for a short time as secretary to the embassy at Paris, and was minister plenipotentiary there from January to March, 1815. At Waterloo he lost his right arm, and received subsequently the appointment of aide-de-camp to the prince regent, the dignity of K.C.B., and several foreign orders of merit. From 1816 to 1819 he acted as secretary to the embassy at Paris; and from 1819 to 1852 as military secretary to the Duke of Wellington during the latter's tenure of the posts of master-general of the ordnance (1819–27) and commander-in-chief (1827–52). He attended the Duke of Wellington at the Congresses of Vienna and Verona, and in 1826 accompanied him to St. Petersburg on his mission to congratulate the Emperor Nicholas on his accession. In 1852 he was made master-general of the ordnance, and in October of the same year was elevated to the House of Peers by the title of Baron Raglan. On the breaking out of the Russian war he received the appointment of commander of the forces, and proceeded in that capacity to Turkey. The incidents of the campaign are well known. Throughout that eventful period Lord Raglan displayed great personal bravery, if not military genius, and rendered himself universally beloved throughout the army by his amiable and conciliatory temper. The difficult position in which he was placed, and the total inefficiency of the commissariat and other arrangements, over which he had little or no control, hampered and impeded his movements; and in esti-

mating his abilities, as displayed in this conjuncture, it is necessary to make large allowance for these circumstances. The disastrous repulse of the allies in their attack on the Redan, 18th June, 1855, seems to have weighed heavily on his spirits, and the disease under which he was labouring at the time—a mild form of cholera—was from that date greatly aggravated; and he expired in the camp before Sebastopol on the 28th of the same month. Lord Raglan married in 1814 the Hon. Emily Harriet Wellesley Pole, niece of the Duke of Wellington, and left by her one son and two daughters. His eldest son, the Hon. Major Arthur William Fitzroy Somerset, was killed in India in the first Panjab campaign while serving on the staff of Lord Gough.

RAGMAN ROLL, called also Bagimont's Roll, from a corruption of the name of the legate Benemundus de Vicci, who it is said made up this roll as a rent-roll of benefices in the reign of Alexander III., A.D. 1275, after having summoned all the beneficed clergymen of Scotland and required them to give under oath the true value of their benefices, in accordance with which they were afterwards taxed by Rome. The Roll subsequently falling into the hands of Edward I. of England was by him used as an instrument by which all the nobility and gentry whose names appeared there were compelled to do him homage in the course of his progress through Scotland in 1296. The document was delivered back to the Scotch along with other records and muniments in 1329 in terms of the Peace of Northampton. It is now deposited in the Tower of London, and consists of four large rolls of parchment, formed by stitching together thirty-five smaller pieces. It has been published in Prynne's Records in an abridged form, and also for the Bannatyne Club in 1834, in the introduction to the latter of which will be found the various conjectures—none of them, however, conclusive—that have been advanced regarding the etymology of the term *ragman*. The original instruments of homage under the seals of the parties, of which the Ragman Roll may be regarded as a record, have all perished.

RAGS, worn fragments or shreds of textile fabrics. Rags, valueless though they may be for most purposes, are yet of great importance in the arts, particularly in paper-making. (See PAPER.) Besides the rags collected in the United Kingdom, the article is imported in large quantities from various foreign countries. Linen rags for paper are imported principally from Prussia, Hamburg, France, Austria, and Russia. Woollen rags are also imported in considerable quantities from the continent of Europe, chiefly from Hamburg and Bremen. Foreign rags are much coarser in texture and of a dirtier appearance than the English; but being almost exclusively linen they are more valuable, more especially since the introduction of the process of boiling the rags in ley, and afterwards bleaching them with chlorine, which makes them suitable for the manufacture of fine paper. Woollen rags, not being available for paper, are much used for manure; but those of a loose texture, and not too much worn, are unravelled by means of machinery, and mixed up with good wool, to form what is known as *shoddy*, with which cheap woollen goods are made; while the refuse is pulverized and dyed various colours, to form the flock used by paper-stainers for their flock-papers. Considerable quantities of rags, generally of mixed cotton and linen, are also imported from Turkey, Egypt, India, Australia, and Japan. The extensive use to which esparto grass and other materials are now put for the manufacture of paper has materially affected the rag trade. For example, the value of rags for paper-making imported in 1861 was £338,713, against £7293, the value of esparto and other materials; while in 1882 the value of the former import fell to £303,349, and that of the latter had risen to £1,281,105. The import of woollen rags for 1882 was valued at £820,616. The United States competes closely with Great Britain for the purchase of continental rags, and even enters the English market, as is shown by the large quantities annually exported to that country.

RAGUSA, a seaport town of Austria, Dalmatia, on a peninsula in the Adriatic, at the mouth of the valley of Ombla. It was formerly a republic, with a territory of 500 square miles, and 60,000 inhabitants. It is surrounded by old walls flanked with towers and bastions, but possesses little strength. The houses are built of excellent stone, many of them with handsome balconies. The more remarkable edifices are the cathedral, the church and convent of the Franciscans, the church and convent of the Jesuits, the former considered the finest building in Ragusa, and the latter now used as a military hospital; the governor's palace, an ancient structure in the Florentine style, with fine arcades and arched windows; the custom-house; the Opera Pia, a kind of house of refuge for young females; and various other charitable institutions. Outside the town are two extensive suburbs, in one of which is a large and well-supplied bazaar, and near it is the lazzaretto. The manufactures, of little importance, consist chiefly of silk and woollen goods, and ordinary and morocco leather; but the trade with Italy and the Levant is extensive, and has the advantage of two good harbours. Ragusa is the see of a bishop, the residence of a governor, and the seat of several important courts and public offices. It is of very early origin, and is supposed to have been founded by Greeks in 656. It fell under the power of the Romans, then under that of the Greek emperors, and finally asserted its independence, which it successfully maintained, both against the Turks and the Venetians. Its most flourishing period was from 1427–40, and it preserved its liberty by the payment of a tribute to the Porte. In 1806 it was taken possession of by the French, and in 1810 was incorporated with the government of Illyria. In 1814 it was given to Austria. It has repeatedly suffered much from earthquakes, more especially that of 1667, by which great part of it was laid in ruins. Boscovich, the mathematician, was born here, and lies buried in the cathedral. Pop. (1880), 7245.

RAGUSA, a town of Sicily, in the province of Woto, 29 miles W.S.W. of Syracuse, on the right bank of the river of its name. It contains several churches and convents, considerable manufactures of silk stuffs, and a trade in corn, wine, oil, horses, and mules. It is supposed to stand near the site of the ancient Hybla Hereæ. Pop. (1881), 24,183.

RÂHU, the hero of a curious legend in the mythology of the Hindus, who is supposed to be the cause of the eclipses of the sun and moon. He played a conspicuous part in the war which the Dânavas or demons, in conjunction with the Daityas, waged against the Adityas or gods. The motive of the war was the possession of the *amrita* or beverage of immortality. The gods themselves had need of this beverage, and in order to procure it they set themselves to churn the sea, which they executed in the following fashion. Having taken up Mount Mandara, they encircled it with the serpent Vâsuki, using it as a cord, and then the gods taking one end and the demons the other, they applied themselves most energetically to beating the ocean. As soon as the amrita appeared a fearful contest ensued between the gods and the demons for its possession. The contest resulted in the defeat of the latter, among whom was Râhu. Râhu, however, similated a god that he also might drink of the beverage; but the sun and moon wit-

nessed the fraud, and denounced him, and at the very moment the amrita touched his lips Vishnu struck off his head. The head of Râhu, however, having become immortal through touching the amrita, rose, says the Mahâbhârata, in semblance like the summit of a mountain into the air, giving forth at the same time a terrible cry. From that time the head of Râhu has manifested an implacable hatred towards the sun and moon, and it is his efforts to devour them that cause the eclipse of these orbs.

RAHWAY, a town of the United States, in Union county, New Jersey, 39 miles north-east of Trenton; with seven churches, an academy, a female institute; a tannery, a distillery, a paper-factory, and numerous flour, grist, and saw mills. Pop. (1880), 6455.

RAIBOLINI, FRANCESCO, usually called Francesco Francia, a famous Italian historical painter, regarded as the head of the Bolognese school, was born at Bologna about the middle of the fifteenth century. He was at first intended for a goldsmith, and distinguished himself by the excellence of his workmanship. He executed a number of most beautiful medals, and was in consequence appointed superintendent of the mint at Bologna. As a painter he was the scholar of Marco Zoppo, whom he soon surpassed: Perugino also appears to have had considerable influence on him, but little more is known of the circumstances of his life than that his school at Bologna was numerously attended, and that he died there in 1533. He was highly esteemed by Raphael, who in 1518 intrusted him with the improvement of his St. Cæcilia. He excelled particularly in Madonnas, and executed a number of admirable frescoes in the church of St. Cæcilia at Bologna, but his most famous work is a St. Sebastian in the church of Della Misericordia in the same city. Three works of his are in the National Gallery, one of which, the Virgin and Two Angels weeping over the Dead Body of Christ, is of rare power, and one of the most precious in the collection. Raibolini had a son, Giacomo, who studied under him, and acquired considerable celebrity.

RAIL (*Rallus*), a genus of Grallatorial or Wading Birds, forming the type of a distinct family (Rallidæ) of that order. The Rails possess bills of moderate length, not longer usually than the head, and of a wedge-shape and compressed form. The nostrils are placed in grooves on the upper surface of the mandible on each side, and the nostrils themselves open through the bill. The legs are shorter than in the generality of Wading Birds, the toes, however, being very long, and provided with claws or nails of considerable length. The wings are of moderate size, and the neck is short, the head being small. The tail is short, and the body presents generally a somewhat compressed form. As a group the Rails, whilst included in the Grallatorial order, present many points of affinities to the Rasorial or Gallinaceous Birds. They generally inhabit swampy places, the food consisting of vegetable and animal matter. The nest is usually placed on the ground amid sedges and reeds, and consists of dried grasses woven together. The young are autophagous, that is, can feed themselves and run about and swim whenever they are hatched. The Common or Water Rail (*Rallus aquaticus*)—shown in Plate CL.–CLI. fig. 3—possesses a slender elongated bill, both mandibles being slightly curved, and their margins inflected beyond the nostrils. The Land Rail, so named, is the Corn-crake (*Crex pratensis*), also included in this family. (See CORN-CRAKE.) The throat in the Common Rail is whitish, the sides of the head, breast, belly, and neck being of a leaden colour; the upper plumage is reddish-brown, with deep black in the middle, the sides being black, striped with transverse white bands; the lower tail-coverts are white, the bill reddish and brown, and the feet of a brown flesh-colour. The young possess the plumage of the middle of the belly of a brownish-red colour, the abdomen generally being blackish, but without the white markings. The males are generally the larger, and the sexes appear to be of similar plumage. The Common Rail occurs all throughout Europe, but it is much less plentiful in Britain than formerly. It is found most abundantly in the swamps of Holland, France, and Germany; it is said also to occur in Japan. These birds do not appear to be migratory in habits, like their allies the Crakes. The Rail is a shy bird, and is little known to ordinary observers, chiefly on account of its retiring habits. The eggs are yellowish-white, marked with brown spots; and the young, when first hatched, are covered with a black down. The flesh is very palatable.

RAILWAYS, roads made by placing lines of smooth and parallel bars between one place and another, in order to diminish the resistance to transport of wheeled vehicles, which are run upon the bars or rails, and to enable them to be drawn at higher velocities. The necessity for railways originated in the requirements of the coal-traffic of Northumberlandshire, where the first railways, formed on the plan of making a distinct surface and track for the wheels, were constructed. In 1676, near Newcastle-on-Tyne, the coals were conveyed from the mines to the banks of the river, 'by laying rails of timber exactly straight and parallel; and bulky carts were made, with four rollers fitting those rails, whereby the carriage was made so easy that one horse would draw 4 or 5 chaldrons of coal.' The rapid wear of timber led to the structure of cast-iron rails 100 years afterwards, about 1776, to replace the wooden ones; and being limited in width they were formed with a continuous flange or ledge on their inner edge, to keep the wheels on the track. The roads were then called 'tram-roads,' having been first laid down, it was said, by Outram, from whose name, omitting the first syllable, the word is said to have been derived.

The leading objection to this system—the once famous tram-road—was that the rail was liable to be covered with dust or gravel. Jessop, in 1789, to obviate these disadvantages, laid down at Loughborough cast-iron 'edge-rails,' from which the guiding ledges were removed and applied round the edges of the wheels, forming flanges, the rail being elevated sufficiently to allow the descending flange to clear the ground. This appears to have been the first system of rails laid on cast-iron chairs and on sleepers: the chairs (so called because they support the rail) being placed at short intervals, and the sleepers (so called because they are supposed to rest undisturbed in the ground) consisting of stone blocks placed under the chairs. But the rails, having been hitherto of cast-iron, proved to be liable to fracture under the loaded waggons and the locomotive engines by which they were drawn, and accordingly, in 1820, Mr. Birkenshaw introduced the 'fish-belly' rail, which was of rolled wrought-iron, similar in form and mode of support to Jessop's rail, but rolled in continuous lengths, embracing a number of spans, with stiffening edges or flanges on the under side. This form of rail grew into favour, and was adopted in the construction of the Liverpool and Manchester Railway, which was opened in 1829. The rail weighed 33 lbs. per yard length, and was laid in cast-iron chairs, spiked down to square stone blocks at distances 3 feet apart. (For the application of steam to railways, see LOCOMOTIVE ENGINE.)

The Permanent Way.—As in all roads, the first consideration is the use to which a railway is to be

RAILWAYS.

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

Fig. 7.

Fig. 8.

J. W. Lowry, Sculp.

BLACKIE & SON, LONDON, GLASGOW, EDINBURGH & DUBLIN.

RAILWAYS.

PLATE CLXVI.

Fig. 1.

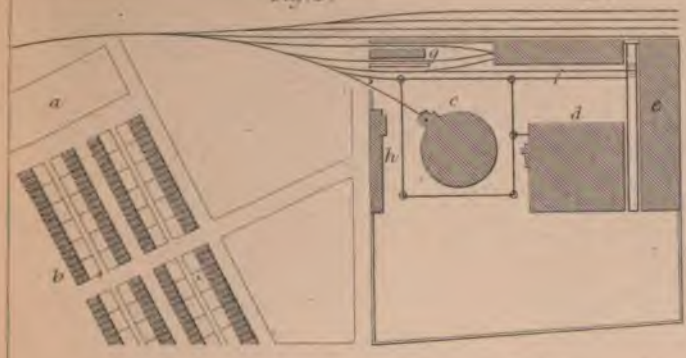


Fig. 2.

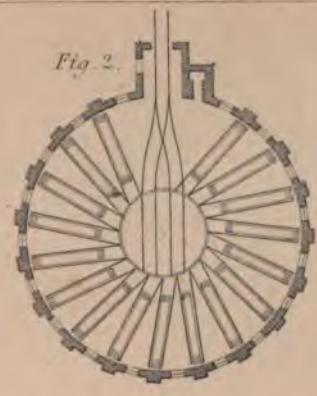
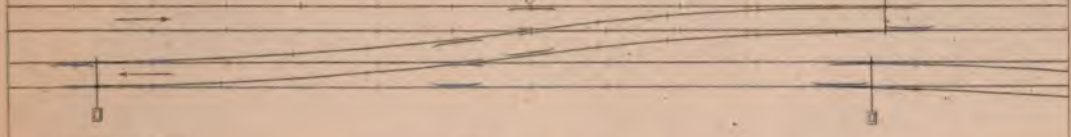


Fig. 3.



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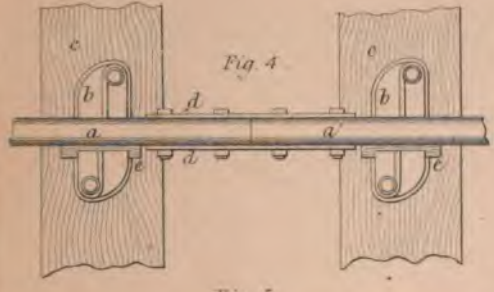


Fig. 5.

Fig. 6.

Fig. 9.

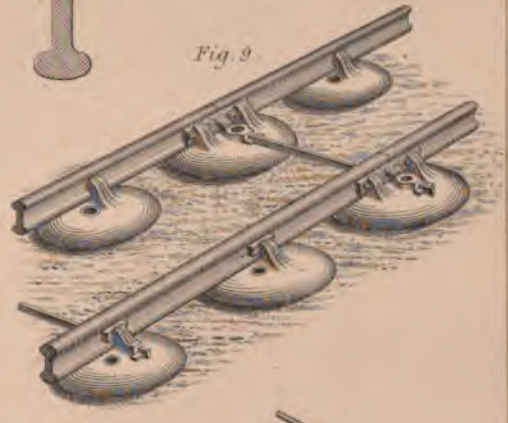


Fig. 7.

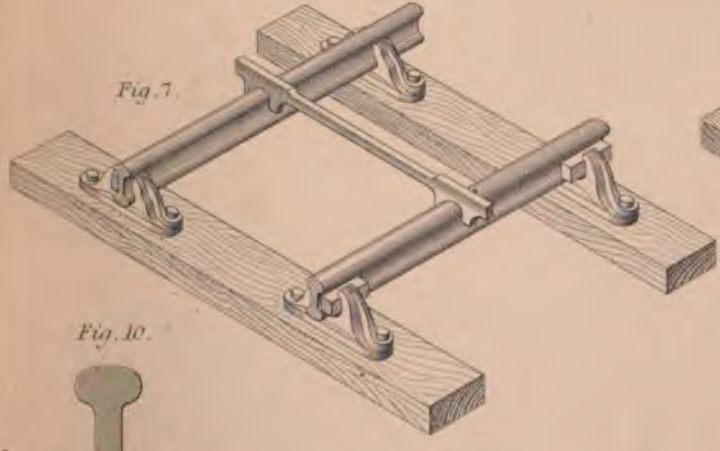


Fig. 8.

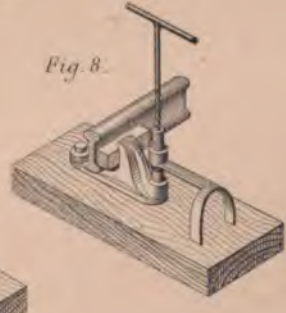


Fig. 10.

Fig. 11.

J. W. Lowry, faulpt.

BLACKIE & SON, LONDON, GLASGOW, EDINBURGH & DUBLIN.

applied, and the weight on the wheels that are to run over it. A very common mistake is to make the road —that is, the permanent way, as it is called, in distinction from the temporary rails used by the constructors in making the road—too weak. This was largely the case with American roads. One of their earliest forms of rail consisted of a flat bar half an inch thick spiked down to longitudinal timbers. In the process of running the trains the iron was curved, the spikes loosened, and the ends of the bars turned up, and were known by the name of 'snakes' heads.' Occasionally they pierced the bottoms of the carriages and injured passengers, and it was no uncommon thing to hear passengers speculate as to which line they should go by, as showing fewest snakes' heads.

The next consideration is that the road should be thoroughly well drained, that all rain-water falling on the line may have facility to run off the surface without soaking in, and that all running water crossing the line may be provided with culverts to pass below it. The sleepers or substructure should be bedded on at least 12 inches in depth of porous stone or gravel, constituting the ballast, without any clay or other material in it that may make an impervious bed. In many places natural ballast is not to be had, and where clay exists the process of burning the clay is resorted to. The rails should be stiff both vertically and laterally, so that they should neither yield to the lurches of the engine and the train, nor to the heavy loads carried on the wheels, and sustained by the rails at the points where the wheels roll over them in succession. The earliest rails made in England were carefully manufactured of good tough iron, and was calculated to stand the wear and tear of 100,000 trains of 150 tons each before being worn out. In 1857 the substitution of steel for iron wrought a great change in railways, giving about a six times greater endurance in respect of wear, and a considerable increase in the power of resisting strains and jars.

The general appearance of the ordinary double line of rails—the *up line* and the *down line*—of an ordinary railway is shown by fig. 3, Pl. CLXVI., in which the arrows indicate the reverse directions of the trains. The joints of the rails also are ticked off. Figs. 4 and 5 represent in plan and elevation, on an enlarged scale, a portion of the rail, showing in fact two rails *a*, *a'*, resting in the cast-iron chairs *b b*, on the wood sleepers *c c*; the ends of the rails are united by two 'fish-plates' *d d*, the invention of Mr. W. B. Adams, placed one on each side, and bolted together. The rails are keyed in the chairs by the oak keys *e e*. Fig. 6 shows the sectional form of the rail. Figs. 7 and 8 indicate the method of gauging the rails, and drilling the holes for the trenails or spikes to fasten down the chairs on the sleepers. Mr. Greaves' method of supporting the rails on cast-iron sleepers in the form of inverted pots is shown by fig. 9; this plan has been considerably used in Egypt and India, being of a more durable material than timber. Fig. 10 shows a species of foot-rail, in section, much used in America and on the Continent of Europe. Fig. 11 shows the bridge-rail, known also as the Brunel rail, having been introduced by the late Mr. I. K. Brunel.

Gauge of Way.—The gauge or measure of a railway is taken as the distance apart of the upper surfaces or treads of the two rails forming a line of rails or way. In England there are two gauges, known as the 'narrow gauge,' 4 feet 8½ inches wide, and the 'broad gauge,' 7 feet between the rails. The narrow is the national gauge of Great Britain, having been employed by the elder Stephenson for the Liverpool and Manchester Railway, and thereupon adopted for other lines, with a few exceptions, the most important of which is the broad gauge, 7 feet, introduced by the younger Brunel on the Great Western Railway. The inconveniences of the break of gauge at the junctions of the narrow and the broad gauges, particularly with respect to the cost and delay of transferring passengers and goods, have, however, within the last few years been felt to such a serious degree that it has been decided to extend the narrow gauge over the whole of the Great Western system, and gradually to eliminate the broad gauge of way. The other exceptional gauges have already been reduced to a uniformity with the narrow gauge. The gauge of railways in Ireland is uniformly 5 feet 3 inches, being 6½ inches wider than the English gauge, giving more room for the construction of the rolling stock. The European gauge is for the most part the same as the English; but the Spanish gauge is wider, being 5 feet 6 inches, and constituting a break of gauge with France, commercially inconvenient, but supposed to be politically expedient. The gauge of railways in India also is 5 feet 6 inches. The American gauge is various, from 4 feet 8½ inches to 6 feet—some of the gauges varying about an inch, and they interchange rolling stock, which, of course, runs tight and loose, but they blunder through it. The English national or Stephenson's gauge is practically of sufficient width. In fact certain engineers, being of opinion that even the narrow gauge is wider than is really needful, have constructed lines of still narrower gauges—3 feet 6 inches, 3 feet 3⅜ inches or 1 metre, 3 feet, and even 2 feet wide. The feats of traffic which have been performed on such narrow gauges have been unexpectedly considerable. It has, however, been amply proved that the balance of economy claimed for the narrower gauges has been overrated, and that any material deviation from the ordinary gauge is not warranted by the commercial results of practice.

Route.—Engineers endeavour so to plan the works of a railway that the earth to be excavated from the hilly ground shall be equal to the embankment on the valleys—effecting a re-distribution of material rather than its removal, and arriving at the desired result by the simplest means and in the most economical manner. A straight and horizontal line is the standard of perfection; and the proper business of the engineer in laying out a railway is to harmonize the engineering and financial conditions of the problem, so as to yield the greatest return in proportion to the money expended; and that whilst the railway may be neither quite straight nor quite level, it should not be excessively costly in construction in order to be free from severe curves and steep gradients, nor excessively cheap, making a heavy line and incurring heavy working expenses. There is a wise discretion to be exercised in laying out the route of a new railway; neither, on the one extreme, to divert it hither and thither to avoid every difficulty or embrace every eligible district on the route; nor, on the other extreme, to carry it with absolute directness, as the Emperor of Russia willed when he laid out the route of the St. Petersburg and Moscow Railway on the map of Russia, by means of a ruler and a pencil, drawing a mathematically straight line between the two capitals.

Earthworks.—The earthworks of a railway are the foundation and support of the whole superstructure, and as such should be uniformly firm, and carefully considered with respect to material, preparation, form, and drainage: of liberal width, easy lateral slopes, ample ballast, thorough drainage. Fig. 1, Pl. CLXV., shows in transverse section the ordinary formation of a cutting in earth: the formation-level *a a*, 33 feet wide, is bounded by the side drains

b b, for carrying off the rain-water or melted snow from the ballast. Beyond the side drains the slopes ascend to the natural surface of the ground at the rate of 1 foot rise to 2 feet horizontal, or, briefly, 1 to 2. Upon the formation-level the ballast *c c* is deposited 2 feet in depth, and about 23 feet wide at the top, being so wide in fact as to extend 4 feet on each side beyond the outermost rails. The sleepers and chairs are buried in the ballast; the rails also are partially covered with the ballast, with the exception of 2 or 3 inches which remain above the ballast, so that the rails may remain clear of gravel or other superficial obstructions, and have a clear way for the wheels. The total width of the cutting at the base *d d* is 42 feet. Embankments are the reverse of cuttings, being elevated *above* the surface of the ground, whilst cuttings are sunk below. They are, in general outline, according to fig. 2, being regulated by the same general dimensions as cuttings are. These dimensions are for the narrow gauge lines. For broad gauge lines the cuttings and embankments are wider. In both gauges a clear space, 6 feet wide, is allowed between two lines of rails. Cuttings are as deep as from 50 to 100 feet below the surface, and embankments are similarly as high above the surface. The London and Birmingham Railway had upwards of 12,000,000 cubic yards of excavation, and 10,500,000 of excavation in the original estimates, or above 200,000 cubic yards of earth-work per mile. The heaviest cutting on the line is at Tring, 2½ miles long, averaging 40 feet deep, the greatest depth being 60 feet. The Winchburgh cutting, on the Edinburgh and Glasgow Railway, is 4 miles long, and from 25 to 60 feet deep, through solid whinstone rock; it is succeeded by an embankment 1½ miles long and 60 feet high, followed in immediate succession by a stone viaduct half a mile long and 80 feet high. In the formation of the famous roadway over Chat Moss, on the Liverpool and Manchester Railway, 670,000 cubic yards of peat were consumed in forming 277,000 cubic yards of embankment. Large quantities of embankment sank in the moss; and when the engineer, after a month's vigorous operations, had made up his estimates, the apparent work done was often less than at the beginning of the month. Chat Moss was 4 miles across; cattle could not stand on it, and a bar of iron would sink in it. The railway was made to float on the bog; and it must be allowed that the mastering of this situation, unprecedented at the time, afforded an unequivocal proof of that admirable self-reliance which never contemplated failure.

Tunnels.—In passing through the consecutive cuttings of a railway travellers usually consider that those through rock must have been desperate undertakings, very much more expensive than cuttings through clay. Their relative costs, however, do not greatly differ; for not only does the vertical rock-cutting require less excavation than the wide yawning earth-cutting of the same depth, with extended slopes, but when it is executed the rock-cutting is not liable to the expensive slips which sometimes overtake the other. It is usual to prefer cutting at any depth less than 60 feet below the surface of the ground; for greater depths it is usually cheaper to tunnel. The history of the Kilsby tunnel, on the London and North-Western Railway, is interesting; the engineer's deliberate opinion was that the line ought to pass through the town of Northampton, an arrangement which would, if executed, have vastly enhanced the commercial prosperity of the town. The inhabitants, however, opposed the project, and succeeded in distorting the line *via* the Kilsby tunnel—which, if the projected plan had been adopted, would not have been required—to a point 5 miles off. It was not then considered that railways could supersede mail and stage coaches; they were regarded as, and declared to be, 'but smoky substitutes for canals.' The tunnel is 160 feet below the surface, it is 1 mile 3 furlongs long, 30 feet wide, and 30 feet high, and has two wide air-shafts, 60 feet in diameter, descending from the surface, to admit light as well as air, to enable the engine-drivers to see the rails from end to end of the tunnel. The tunnel cost nearly £300,000, or £125 per yard running. The famous Box tunnel, on the Great Western Railway, was another difficult and expensive work, placed 70 feet below the surface; it is 1¾ miles long, and it has eleven air-shafts. The tunnel under the Mound, at Edinburgh, on the Edinburgh and Glasgow Railway, is formed circularly, 28 feet in diameter. Fig. 3, Plate CLXV., is an elevation of one end of the tunnel, and fig. 4 is a section, showing the circular arch of the tunnel, built of brick, 3 feet in thickness, with the counterfort under ground, on which the tunnel and its superincumbent load may be conceived to float—the Mound being in fact an accumulation of loose earth and rubbish deposited in the valley which separates the new town of Edinburgh from the old, on a boggy soil.

The longest English railway tunnel is the Stand Edge tunnel, on the London and North-Western Railway from Liverpool and Manchester to Huddersfield and the north, its length being 3 miles and 60 yards. The next longest is at Woodhead, on the Manchester, Sheffield, and Lincolnshire Railway, 3 miles and 60 feet long.

The underground system of railways—the Metropolitan and the District Railways—which has been for several years in operation in London, is a remarkable application of the tunnel, whereby lines of railway are carried through the metropolis into the heart of the city, and circulate an enormous daily traffic between the city and the western districts. The length of the combined system is upwards of 20 miles, nearly three-fourths of which is underground.

Bridges and Viaducts.—The general appearance of an ordinary brick or stone bridge is represented by fig. 5, Plate CLXV., showing a bridge over or under a railway. If across a cutting, over a railway, the foundations are laid in steps on the solid natural earth, as indicated by dotted lines on the left of the figure; if under the railway, in continuation of an embankment, the foundations are built up square from the solid ground, as indicated on the right of the figure. Many bridges have been built of timber and of cast-iron; but these materials—the former for want of durability, the latter on account of its brittleness and uncertainty—have generally been superseded by wrought-iron, forming plate-girder bridges. There are many stone viaducts of great length. The viaduct over the Almond valley, on the Edinburgh and Glasgow Railway, is 720 yards long, or nearly half a mile, having thirty-six segmental arches, each 75 feet span. The Redburn Viaduct, on the same railway (represented in fig. 6), contains eight segmental arches, 50 feet span. The Ballochmyle Viaduct, over the river Ayr, on the Glasgow and South-Western Railway, spans the river by a semicircular arch of 180 feet span—the largest span of railway masonry in this country, or probably anywhere—with six smaller arches of 50 feet span, shown in figs. 7 and 8, the elevation and plan. The only other stone bridge of greater span is the common-road bridge over the Dee at Chester, 200 feet span.

The Congleton Viaduct, on the Manchester and Birmingham Railway, is perhaps the longest in England; it is of stone, 1026 yards, or more than half a mile long, and 106 feet high; it cost £113,000, or

£112 per yard run. The Avon Viaduct, on the Midland Railway, is of brick, 240 yards long, 51 feet high, with eleven arches of 50 feet span; it cost £14,000, or £60 per yard run. The Britannia Tubular Bridge, across the Menai Straits, is 616 yards, or more than a third of a mile in length, and 102 feet high; it cost £600,000, or £974 per yard run. On the different lines entering London there are more than 11 miles of brick viaducts in the approaches to termini. At Manchester and other large cities and towns there are miles of similar works, extending often as far as the eye can reach. There are at least 80 miles of viaducts in the United Kingdom.

The late Sir William Fairbairn was the pioneer for the introduction of railway bridges constructed of wrought-iron plates rivetted together. The first wrought-iron tubular girder-bridge constructed by him, was erected for the purpose of carrying the Blackburn and Bolton Railway over the Leeds and Liverpool Canal. The span of the bridge is 60 feet; there are three longitudinal girders, between which the platform of the bridge is constructed, to carry two lines of rail, one line between each two girders. Each girder consists of a rectangular-cellular top, composed of plates; two vertical side plates, and a bottom consisting of two plates ¾ inch thick rivetted together. The cellular form of the top was adopted, as that which was found to be the strongest form for resisting the compressive strain, tending to rupture by buckling or doubling up the plates; whilst the simple plate form of the lower member of the girder was best adapted to resist the tensile strain to which it is subject.

The comparative economy of the wrought-iron girder-bridge as compared with a cast-iron bridge of equal span and strength, is exemplified in the bridge which has just been noticed. It contains 30 tons of wrought-iron, which cost £900; whereas a cast-iron bridge for the same situation would have cost half as much again, and would have contained in the aggregate three times as much metal.

Amongst the earliest, and still the most remarkable of wrought-iron railway bridges, the Britannia Bridge connects the island of Anglesea with the mainland of Wales. This bridge was designed by Mr. R. Stephenson to carry the Chester and Holyhead Railway across the Menai Straits, and is represented in Plate XXVII. It consists of two wrought-iron 'tubes'—literally, rectangular boxes—with open ends laid side by side, through each of which the trains pass, on a line of rail laid on the floor of the tubes. The tubes rest on two abutments at the ends, and on three intermediate piers, on which they are supported at a clear height of 100 feet above high water-level. Each tube is 14 feet wide, and 26 feet in height inside, at the central portion, and is 1513 feet in length, which is considerably more than a quarter of a mile. The two middle spans measure 460 feet between the piers, and the two side spans are 230 feet. The total length of the bridge is 1842 feet, or over a third of a mile. The enormous number of rivets used in the construction of the bridge amounted to 2,000,000. The total weight of iron consumed amounted to about 10,000 tons.

More recently the girders of wrought-iron bridges have been constructed of lattice-work, instead of continuous plates, as in the bridges which have been described; and it is thought that equal strength is obtained with less material. For illustrations of railway bridges of the tubular and the lattice form of construction, see article BRIDGE, and Plates XXVI. and XXVII.

Stations.—The great theatres of the operations incidental to the transfer from place to place of persons and goods, preliminary and subsequent to the transport, as well as at certain epochs in its progress, are the stations. Stations are either 'terminal' or 'intermediate.' The vast buildings and their dependencies which constitute a chief terminal station of a great line of railway consist primarily of three distinct departments—1. The passenger station, appropriated to the embarkment and disembarkment of the passengers, and other objects of traffic, as small parcels and mails, which are carried by the same trains. 2. The goods station, which is appropriated to the reception and embarkment, and the disembarkment and discharge, of goods and live-stock transmitted by railway. 3. The locomotive, carriage, and waggon depots, where the engines and the carrying stock repose, are cleaned, examined, and repaired. At many intermediate stations the same arrangements, on a smaller scale, are made; in all of them there is at least accommodation for the passenger and the goods traffic.

The selection of intermediate stations, their number, situation, and arrangement, is influenced mainly by the nature, extent, and occupation of the local population; and the first step should be to get a good map of all the places within the scope of the railway, and to mark upon it the population of each place from the last parliamentary census. There is no doubt that the greater the number of stations, the more the travelling increases; for it is found that quick and cheap transit by railway not only increases the existing traffic, but actually creates traffic where none was to be found before. In an engineering point of view, every effort should be made to secure for a terminus or other important station, and for stations generally, a position on the surface, rather than on an embankment, or a viaduct, or in a cutting. Facilities of access in all directions from the surrounding districts, with good roads in the case of passenger traffic, and good water and railway communication for goods depots, are obviously indispensable. For safety and regularity there should be an uninterrupted view along the line of railway, by avoiding sharp curves and a complication of over-bridges in the vicinity of a large station.

The St. Pancras (Euston Road) terminal station of the Midland Railway is said to be the largest in existence. The platforms are covered by a roof with a span of 240 feet. King's Cross station is another most extensive metropolitan station. It was built originally for the use of the Great Northern Railway only, but was afterwards modified and extended in the goods department, to accommodate the traffic of the Midland Railway, which, by an extension across the country from Leicester station to Hitchin station, on the Great Northern line, found an entry into London by King's Cross, independently of the London and North-Western route. The whole station, for passenger and goods traffic, and for the purposes of the locomotive department, covered 26 acres of ground, as originally laid out, and contained 18½ miles of lines of rail. It has since been greatly enlarged.

Huntingdon station, on the Great Northern Railway, is one of the principal intermediate stations on the line. The station-yards are bounded by a road at one end and a river at the other, and the platforms are necessarily opposed. The main line is kept entirely free of turn-tables, which are placed only on sidings. The station is 760 yards in length, or nearly ½ mile between the extreme points of the switches, and there are 3430 yards of siding, single line, or about 2 miles of siding in all, besides the up and down through lines.

The ordinary stations on this line are, with a wise economy, constructed to accommodate a great expansion of traffic. They are 700 to 800 yards in length

between extreme points, or nearly $\frac{1}{2}$ mile, and they contain about 2000 yards of sidings, single line, or more than $\frac{3}{4}$ mile total length.

Extent of Sidings.—The increasing traffic of the older railways has led necessarily to a greater use of the side lines, an increase of siding room, and an extension of stations. The distribution of siding accommodation on the London and North-Western Railway, as it existed in 1853, is instructive. On the main line of the southern division, from London to Birmingham, 113 miles, there were in all 53 miles of siding, single line; and on the total length of line, 315 miles, there were 88 miles of siding, single line: in the proportion of about half the whole length for the trunk, and above a fourth for the whole division, or 1 mile of sidings, single line, to $3\frac{5}{8}$ miles of railway. For the total length of railway, 635 miles, there is 1 mile of siding, single line, to $5\frac{1}{2}$ miles of railway, the stations averaging about 4 miles apart. The great preparation for the accommodation of the traffic thus forcibly indicated by the proportion of siding room, suggests the great magnitude of the business done.

Locomotive Stations.—Locomotive stations should be situated at or near the principal terminus of the railway, sufficiently near to a large town to insure the facility for obtaining materials and workmen; and sufficiently far off to be clear of the heavy local taxes with which such large establishments in all large towns are burdened.

The locomotive station of the Manchester, Sheffield, and Lincolnshire Railway is selected for illustration. It is situated at Gorton, about 2 miles from Manchester, the first position where the railway and the land take the same level. The total quantity of land purchased is nearly 20 acres, about 9 of which are occupied by the workshops and store-yard; the remainder is used for the construction of reservoirs for supplying the works with water, and for erecting cottages upon it for the work-people in the company's service.

The block-plan (fig. 1, Pl. CLXVI.) shows the general arrangement and relative positions of the shops, cottages, reservoirs, &c. The reservoirs *a* are calculated to hold a month's consumption of water, and are supplied from the adjoining canal, the water passing through filter-beds in its course from the canal to the reservoirs. These reservoirs, from their elevated position, supply the water directly into the tenders upon the railway, and throughout the workshops, the canal being at a sufficiently high level to supply them. The cottages *b* are 140 in number, arranged in four blocks. The plan of the works is nearly square, the entrances being placed towards the cottages on the east side of the works; and adjoining are the offices and general stores *h*.

The engine-house, or shed for engines on duty, *c*, is a rotunda of 150 feet in diameter inside, and is capable of holding seventeen engines with their tenders, leaving the entrance and exit lines clear. The advantage of this arrangement (shown more in detail in fig. 2) over the ordinary polygonal engine-house is in the absence of pillars for supporting the roof, of which there are twelve for a twelve-sided polygon; in this building there is but one column at the centre. To the left of the entrance is a furnace for holding live fuel, from which the engines are lighted; and there are two lines of rails across the central turn-table, on one of which the engines enter, and on the other depart. Between the rails of each radiating line a pit is constructed to afford access below the engines for inspection. The roof is of wrought-iron, surmounted by a louvre for ventilation, which is glazed to admit light freely. To the left of the rotunda are the workshops, with stationary engine-house and boiler. The fitting and tool shop contained in the block *d* is 120 feet by 60 feet, and contains nearly the whole of the tools. The smiths'-shop is contiguous to the fitting-shop, in the same block, and of equal dimensions; it contains sixteen smiths' fires, eight on each side. Next to this is the boiler-shop, of the same size, with eight smiths' fires, and four fires for heating boiler-plates, and a finishing and shearing machine. Next to these is the erecting-shop, 150 feet long by 60 feet wide, containing nine transverse lines of rails, each to hold two engines, so that eighteen engines may be housed here at once. There are travelling cranes in the shop, which traverse it for its full length, and capable of lifting any engine and moving it to any part of the shop.

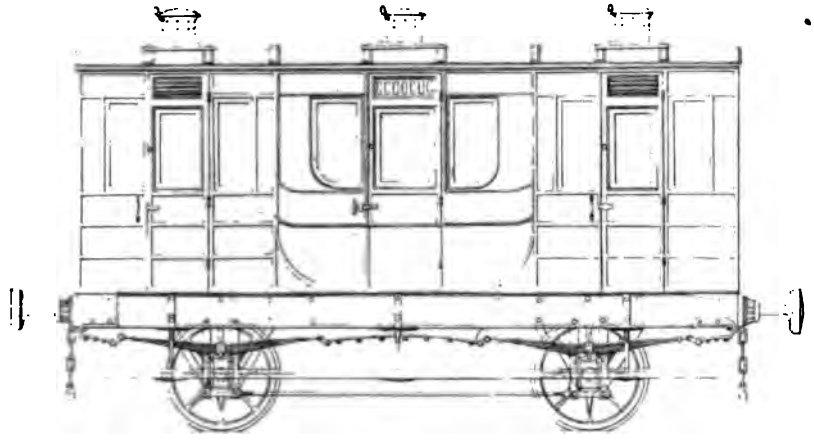
To the left are the carriage and waggon shops *e*, the waggons being on the ground floor, and the carriages above, to which elevation they are raised by a self-acting worm-hoist, worked by the stationary engine. These shops are 320 feet by 70 feet, and can receive fifty waggons and thirty-eight carriages; and attached to them are the lifting-room and the trimming and saddlery room. The lines of rail in the engine and waggon shops are served by a traverser, for means of communication with the external lines. Besides these buildings, there are in the block *f* a paint-shop and a shed for locomotives in reserve, 160 feet by 40; also a coke-shed *g*, 100 feet by 40, so constructed that the coke waggons stand on one side, whilst the locomotives approach and receive their charge of fuel on the other side, the coke being measured into baskets on the intervening platform.

There are four lines of rails into the works, which, with the turn-tables and the arrangement of sidings externally, are shown in the plan, fig. 1. The larger detail plan, fig. 2, shows the rotunda with its central turn-table, and the diverging lines of rail.

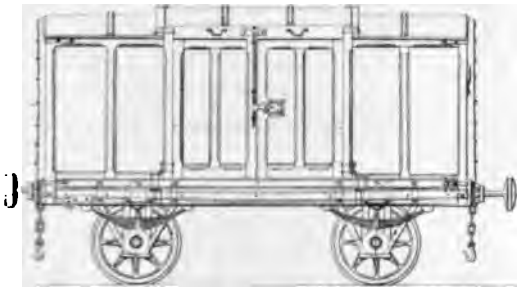
Switches and Crossings.—The use of switches and crossings is to form a link of communication between one line of rails and another, of which many are required at and about railway stations and at junctions, as exemplified in the illustrations fig. 3. They are usually constructed with ordinary rails, and are carried in cast-iron chairs spiked down to sleepers. The switch-rails are movable, and are worked by rods, to which heavy weights are attached, the function of the weights being to retain the points in one position, and to act as a self-acting adjustment in restoring them to it—their normal position—after having been shifted for the passage of a train.

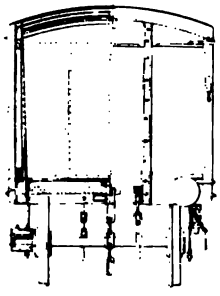
When only one of the terminal rails is movable, it is called a single switch, and is used only on sidings or branch lines of rail; the double switches, being more perfect in action, are adopted on the main line, and, as a general rule, switches on the main line are ordered to be laid with the points in the direction of the traffic, so that passing trains may run out of the points and not into them. 'Facing-points,' as they are termed, are such as are laid on the main line facing or pointing towards the regular advancing trains. Many accidents have been caused to trains by facing-points improperly set or out of order turning the train unexpectedly into a siding, with the impossibility of pulling up in time to prevent a collision, or throwing the train off the rails altogether, producing what is called 'derailment' in modern railway parlance. So dangerous are facing-points felt to be, particularly on high-speed lines, that on some railways they are absolutely forbidden at all except terminal stations, and at intermediate stations where every train is ordered to stop. In some situations this rule can only be followed by sacrificing simplicity and increasing the number of backing-points, but it no doubt diminishes the risk of accident.

Turn-tables.—These are of two classes—for turning



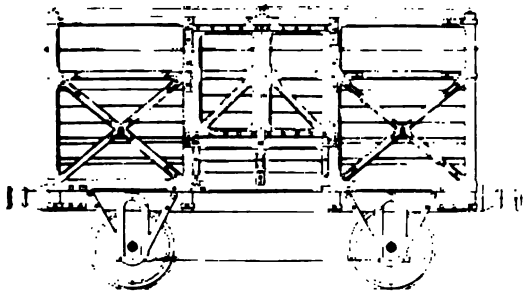
COMPOSITE CARRIAGE - FIRST & SECOND CLASS.





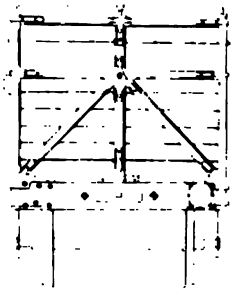
COVERED WAGGON FOR THE AUSTRALIAN RAILWAYS

Side Elevation — *Section and End View*



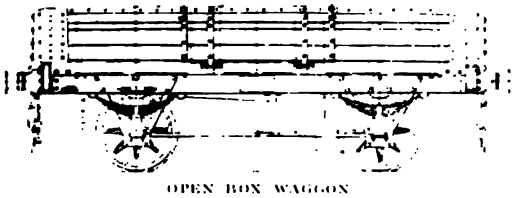
CATTLE WAGGON.

Side Elevation



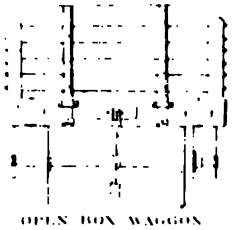
CATTLE WAGGON

End View



OPEN BOX WAGGON

Side Elevation



OPEN BOX WAGGON

End View

carriages and waggons, and for turning engines and tenders together. For the carrying stock they are 12 to 14 feet in diameter, sufficiently large to receive conveniently vehicles of which the wheels are 8 to 10 feet apart between the centres. Turn-tables ordinarily used are of cast-iron, carrying two transverse lines of rails, and revolve upon a central pivot and conical rollers near the circumference, which are upheld and turn upon a cast-iron base bedded in cement, or on a built foundation.

For turning engines and tenders together, and thus superseding the necessity formerly experienced of uncoupling them to be turned on small tables, turn-tables 40 feet long or thereby are required.

Traversers.—These are a convenient substitute for turn-tables, particularly for working a number of parallel lines of rails. A traverser is simply a low rectangular frame, made with two overhung rails, to receive carriages or waggons, and movable on rollers across the lines of rail, so as to receive the carriage from any one line of rail and deposit it on any other.

Water-cranes.—Water-cranes are erected at convenient spots for delivering water to the locomotives. The upright column is firmly erected, and contains the supply-pipe, which ascends within it from the ground. The horizontal member is in direct communication with the supply-pipe within the column; revolving freely, so as to be swung out of the way when not in use. It is sufficiently long to reach over the middle of the line of rails, and has attached to it a leathern hose to direct the current of water into the tender.

Signals.—By common consent railway companies have arrived at the adoption of the semaphore signal for regulating the movements of trains; but the companies do not all work it by the same code. One manager uses it to give two signals, and another to give three; a third will have an auxiliary or distant signal, placed at 500 or 600 yards from the station, to act as a repeating signal, his neighbours perhaps preferring to use it only as a caution. The semaphore is perfect in the simplicity of its form and its action, consisting of a plain, flat board or 'arm,' hinged by one of its extremities to an elevated post or standard. To signal danger, or, in fact, to forbid the passage of an engine or train, the arm is turned straight out, perpendicular to the post; when the line is free for the passage of the train the arm is turned down into a diagonal position, say at 45°, or a rather less angle, with the post. It is now universally agreed that the safest method of working the signals of a railway is what is called the block system, according to which an interval of space, namely, the distance between two signal-boxes, is always kept between two trains on the same line. The signalman at one signal-box does not signal a train to pass until he has received intimation by telegraph that the previous train has passed the next box in advance. Other essential elements of security consist in a clear definition of the duties of the attendant to the signals, their strict enforcement, the selection of the most suitable men, their adequate remuneration, and providing them with convenient, warm, well-fitted lodges, with ample window-space, within which they may keep a constant watch over the line without exposure to weather. At junctions, where the signal-man works the points in connection with the signals, his lodge or box should be raised some height above the surface, to give him perfect supervision in every direction. This keeps him out of the way of gossips, and he is less likely to be distracted in the discharge of his duties. A similar precaution is of service at all other important signal-stations, even where points may not be wrought in connection with signals.

At night it is needful to supply the place of semaphores by large and powerful lamps, with reflectors, capable of showing lights of different colours. Usually a red light is used as the equivalent of the straight-out semaphore, and a white of the inclined semaphore. They are changed either by revolving the lamp on its axis, to present a different side with a differently-coloured glass, or by retaining the lamp as a fixture, and sliding differently-coloured glasses in before the light.

It is easily understood that the regulation of the traffic at the junctions of main lines and branches is one of the most important functions of the signalling apparatus. As the number of junctions increased with the extension and multiplication of railways, it became apparent not only that distinct signals must be given for distinct lines, but that some kind of concerted action must be secured between signals and switches, which might otherwise be conflicting; the signals, for example, might be open for the passage of a train to a particular line of rails when the switches might inadvertently be closed to that line. Accidents, indeed, have happened from such contrary action of the signals and switches; hence the signals and their relative switches or points were connected, so that they would move simultaneously, though it was found that occasionally the switches moved and the signals did not, or *vice versâ*. Subsequently they were interlocked in such a manner that the movement of a signal to the position of safety could not be commenced until after the necessary movement of the switches was completed, and that, on the contrary, the movement of the switches could not be commenced until after all the signals concerned with them had been set fully to danger. The interlocking of signals and switches was first applied at East Retford Junction in 1852. This system is now generally practised. For the working of an ordinary double junction—that is, of the junction of two double lines of way, nine levers are required, namely—up switch lever, down switch lever, up main distant signal, up main junction signal, up branch distant signal, down main junction signal, down branch junction signal, down distant signal. The bare recital of these functions suffices to impress one with a sense of the high state of organization to which the management of great railway systems has arrived.

Carriages and Waggons.—The carriage-stock comprises all vehicles concerned in the conveyance of passengers and their luggage, and of private carriages and horses, the vehicles to carry the latter usually being attached to and run as part of the passenger train in which their owners are conveyed. The waggon-stock comprises the vehicles employed in the conveyance of merchandise, minerals, and live-stock.

The classification of carriages into three or more classes is designed to meet the various requirements of the travelling public, some preferring seclusion, ease, luxury, high speed; others preferring society, if tolerable, and economy, with moderate comfort and moderate speed; others looking to economy simply. For the sake of uniformity externally, and in many of the details, carriages are usually made of the same external length, width, and height, and suitably in the interior. The under works of the stock may thus be identical in construction, and a uniformity of working and wearing parts is thus secured, which is conducive to economy of maintenance.

The waggon-stock should be as nearly uniform as possible. Uniformity of waggons is more important than that of carriages, as their total number and cost are much greater, and the supervision with which they are favoured is less minute; besides, the cost of maintenance is less than where many varieties of

waggons exist on the same line. But whatever may be the upper works, the under works of the whole of the waggon-stock should be entirely uniform. One of the greatest engineering evils that have been inflicted upon railway companies has arisen from the want of arrangement or consultation between the officers of different lines, in order to consider the question, common to all, as to the best plan and construction of vehicles to be used by them. The result has been that several companies have built classes of stock unsuited to work conjointly the traffic of their own and other lines. The diversity of practice is no doubt partly occasioned by the growing wants of traffic and the gradual increase in capacity and tonnage of the carrying stock, incurring unavoidable structural alterations of plan. Amongst the early contributors to the production of the railway waggon were to be found the great carriers, their agents, road-contractors, farmers, builders, wheelwrights, salesmen, glaziers, timber merchants, and others, whose occupations and opinions, it may be imagined, give birth to a wide diversity of practice.

First-class narrow-gauge carriages are commonly divided transversely into three compartments, each 6 feet long and well lined with cushions. In each compartment there are six seats, and there are in all seats for eighteen passengers. In some instances the seat-partitions or elbow-rests are dispensed with, and the whole width of the compartment thrown open to receive four on each side, or twenty-four passengers in one carriage. Saloon-carriages having no compartments are getting into use, as are also sleeping-cars fitted up with beds.

Second-class carriages are usually divided into four compartments, holding eight passengers each, or thirty-two per carriage. They are now cushioned and comfortable enough.

Third-class carriages do not differ very much from second-class, except that they are more frequently uncushioned, and altogether more homely.

The cost of a first-class carriage holding eighteen passengers, for the narrow-gauge, is about £340; and holding thirty-two passengers, for the broad-gauge, about £640. A narrow-gauge open goods-waggon costs £80, and a broad-gauge open waggon costs £140. See Plate CLXVII.

Extent of Railways.—The rapidity with which railway communication has been extended may be estimated from the fact that in 1843 there were little more than 2000 miles of railway open in the United Kingdom, whilst at the end of the year 1882 the total length open amounted to 18,457 miles, showing an average addition of about 450 miles per year. The demand for railway communication is far from being satisfied even now. As traffic increases new portions of lines become necessary in certain localities for the conveyance of passenger or fast traffic, independently of goods or slow traffic. Many districts still without railways are in want of branch lines. The number of miles added in 1882 was 282.

The total length of railway open at the end of 1882 was distributed between the three sections of the United Kingdom as follows:—

England and Wales,	13,052	miles.
Scotland,	2,940	,,
Ireland,	2,465	,,
	18,457	,,

Little more than half of this, however, consists of a double line of way; the rest consists of a single line of way. Making due allowances for the triple and quadruple portions of several of the great lines, and for siding accommodation, which is extensive, it is estimated that there are upwards of 30,000 miles of single line way in the kingdom. The 18,000 miles of railway is the property of about 300 companies, but, as many of the smaller lines are leased to or worked by larger lines, the number of working companies is not much more than a third of that number. The greatest mileage worked by any one company is that of the Great Western Railway, which works more than 2200 miles of railway. The shortest independent lines are the Ryde Pier and the Torbay and Brixham, each of them only 2 miles in length.

Capital of Railways.—The total amount of capital raised for the construction of railways was in 1882 very nearly £767,900,000 sterling, of which there was raised—

For English Railways,	£635,186,800,	or	£48,972	per mile open.
,, Scotch Railways,	97,750,100,	or	33,187	,,
,, Irish Railways,	34,962,660,	or	14,183	,,
,, United Kingdom,	£767,899,560,	or	£41,400	,,

Showing that the average for the whole of the United Kingdom was £41,400 per mile open. In 1858 the average cost did not exceed £35,000 per mile, and the rise in cost since that year per mile of railway forcibly points to the expenditure of recent years in perfecting the railway system.

The following is an approximate analysis of the average cost of the railways existing in 1858:—

	per mile.		per cent.
Law and parliamentary expenses	£2,000	or	6
Land and compensation	7,000	,,	20
Works of construction and stations complete	17,500	,,	50
Locomotive and carrying stock	3,000	,,	9
Interest on stock, discounts, bonuses, dividends from capital, contingencies	5,500	,,	15
	£35,000	,,	100

From this statement it appears that the cost of land and compensation was £7000 per mile, or one-fifth of the entire cost. Out of £315,000,000 of capital, then, £60,000,000 were absorbed in charges for land and compensation.

Railway Legislation.—With regard to the parliamentary expenses since Parliament began to legislate for railways, a multitude of laws have been placed upon the statute-book which will certainly excite the wonder if they fail to be the admiration of future generations. The London and North-Western Railway alone is regulated by nearly 200 different acts! Not only are the statutes numerous—they are irreconcilable in principle and detail. Several different select committees have at various times deliberately reported against the possibility of maintaining competition between railways, and to this principle Parliament has as often assented. Yet the practical operation of the laws which have received legislative sanction has been throughout and at the same time to negative this principle by almost invariably allowing competition to be obtained wherever it has been sought. Whatever may have been the effect for the time, the competition which Parliament permitted has generally been terminated by combination. As Mr. Stephenson put it—'Where combination is possible, competition is impossible.'

The expenses, direct and incidental, of obtaining an act of Parliament have been in many cases enormous, and generally are excessive. There are three parties responsible for such extravagance—Parliament itself, the railway companies, and the land-owners. In 1855 it was shown by a return of Mr. Hadfield—which was, however, far from complete—that the amount expended by existing railway companies in obtaining the acts of Parliament by which they are incorporated was no less, in parliamentary, legal, and engineering

costs, than £14,000,000 sterling! The adherence to useless and expensive forms by parliamentary committees in what are called the standing orders, or general regulations for the observance of promoters of railway bills on the one part, and the itching for opposition of railway companies to resist fancied inroads on vested rights and supposed injurious competition on the other part, have been amongst the chief sources of excessive expenditure. Mr. Stephenson mentions an instance showing how Parliament has entailed expense upon railway companies by the system complained of. The Trent Valley Railway was, under other titles, originally proposed in 1836. It was, however, thrown out by the standing-orders committee in consequence of a barn of the value of £10, which was shown upon the general plan, not having been exhibited upon an enlarged sheet. In 1840 the line again went before Parliament. It was opposed by the Grand Junction Railway Company, now part of the London and North-Western. No less than 450 allegations were made against it before the standing-orders sub-committee, which was engaged twenty-two days in considering those objections. They ultimately reported that four or five of the allegations were proved, but the committee nevertheless allowed the bill to proceed. It was read a second time, and then went into committee, by whom it was under consideration for sixty-three days, and ultimately Parliament was prorogued before the report could be made. Such were the delays and consequent expenses which the forms of the house occasioned in this case, that it may be doubted if the ultimate cost of constructing the whole line was very much more than the amount expended in obtaining permission from Parliament to make it.

'Once the greatest obstacles to railway enterprise,' says a writer in the Edinburgh Review, 'owners of estates have of late years been amongst its chief promoters. . . . When it became known that railway companies commonly paid for land and compensation sums varying from £4000 to £8000 per mile; that men were indemnified for supposed injury to their property by sums so inordinate that the greater part has been known to be returned by the heir as conscience-money; that in one case £120,000 was given for land said to be worth about £5000; when it was bruited abroad that large bonuses, in the shape of preference-shares and the like, were granted to buy off opposition; when it came to be an established fact that estates are greatly enhanced in value by the proximity of railways, it is not surprising that country gentlemen should have become active supporters of schemes to which they were once the bitterest enemies.' The Eastern Counties Railway had, up to 1846, paid not less than £809,950 for land and compensation, equal to about £12,000 per mile. The cost of the land purchased by the original London and Birmingham and Great Western Railway Companies averaged not less than £6300 per mile.

But the most conspicuous example in recent times, which overshadows all others, of excessive expenditure in parliamentary litigation, as well as in land and compensation, is supplied in the history of the Great Northern Railway Company. The preliminary expenses of surveys, notices to landowners, &c., commenced in 1844, and the bill was introduced into the House of Commons in 1845, when it was opposed by the London and North-Western, the Eastern Counties, and the Midland Railways. It was further opposed successively by two other schemes, called the London and York and the Direct Northern. The contest lasted eighty-two days before the House of Commons, more than half the time having been consumed by opposition to the bill. The bill was allowed to stand over till next year (1846), when it began, before the committee of the House of Lords, where it left off in the Lower House in the year 1845, on account of the magnitude of the case. The bill was before the Upper House between three and four weeks, and in the same year (1846) it was granted. The promoters of the rival projects were bought off, and all their expenses paid, including the costs of the opposition of the neighbouring lines already named, before the Great Northern bill was passed; and the 'preliminary expenses,' comprising the whole expenditure of every kind up to the passing of the bill, was £590,355, or more than half a million sterling, incurred at the end of two years of litigation. Subsequently to the passing of the act an additional sum of £172,722 was expended for 'law and engineering expenses in Parliament' to 31st December, 1857, which was spent almost wholly in obtaining leave from Parliament to make various alterations. Thus it would appear that a sum-total of £763,077 was spent as parliamentary charges for obtaining leave to construct 245 miles, being at the rate of £3115 per mile.

During the same period the payments made by the Great Northern Railway Company for 'land and compensation' amounted to £1,901,371, or nearly two millions sterling, at the rate of £7760 per mile. The parliamentary and land and compensation charges together made a sum of £2,664,448, or £10,875 per mile of the original line. The total payments on capital account were £11,299,300, and of this amount those items constitute the formidable proportion of 23½ per cent., being nearly one-fourth of the capital forestalled before the ground was broken.

The particulars of the Peebles Railway may next be quoted, in contrast to those of other lines, as a perfect example of economical construction and legitimate expenditure. The railway is a single line, 18¾ miles in length, from Peebles station to the point of junction with the North British Railway at Eskbank station, 8 miles from Edinburgh. There was no opposition to the project in any quarter, and the land-owners agreed to give the land required at thirty-five years' purchase of the agricultural value, the value and severance damage being fixed by arbitration. Nor did the turnpike-road trustees make any claim for damages. The act was passed in July, 1853, and the actual cost of obtaining it was only £650, no fees to counsel having been found necessary. The total parliamentary expenses up to the obtaining of the act was £1569, but further expenses were incurred in 1857 in applying for power to raise new capital. The charges for land and compensation amounted to £21,222, or £1131 per mile. Seven stations with approaches, including Peebles station, averaging one for every 2¾ miles, were built at an average cost of about £1200 each. The works were constructed for about £3600 per mile, and the locomotive and carrying stock cost about £1000 per mile. The railway was opened in July, 1855, two years after the passing of the act. The total cost at the end of 1858 amounted to £6688 per mile.

Passenger Traffic.—The total number of passengers conveyed in 1882 was about 654,838,000, equivalent to above 18 journeys each for the whole population; but this number does not include the repeated journeys of season-ticket holders, of whom there were 599,568 in 1882. The rapid increase of such traffic may be conceived when it is known that only twelve years before (in 1870) the total number of passengers conveyed was only 336,000,000. The great increase is supplied for the most part by third-class passengers, to whom increased facilities have been extended. This is apparent from the following comparative statement of the number of first, second, and third class passengers in 1870 and 1882:—

together more than seven-sixteenths of the total mileage of the kingdom, and draw yearly not much under three-fifths of the total receipts. Some of the provincial lines, however, are also vast commercial concerns, drawing princely revenues. Thus the North-Eastern, whose net-work spreads over the rich mineral district of the north-east of England, had 1508 miles of railway constructed in 1882, while its gross receipts amounted to £6,728,381. The 'king of railways'—the London and North-Western—represented by a length of 1775 miles open for traffic, carried in the course of the twelve months ending December 31, 1882, the enormous number of 52,145,000 passengers, being nearly a half more than the total population of the United Kingdom. The number of miles run by the trains of the London and North-Western Railway in the year 1882 was 36,999,663—in other words, a distance of more than 154 times that of the moon from the earth, or say equal to 77 return journeys to and from the moon. The gross receipts of the London and North-Western in 1873 from passenger traffic amounted to £3,607,590, and from goods traffic to £5,044,574. The total revenue in the year ending December 31, 1882, was £10,334,701, or not very much under the national income of Belgium. A still higher mileage than that of the London and North-Western is now worked by the Great Western, which at the end of 1882 had 2239 miles open, and earned in that year a revenue of £7,810,681. Next of the English provincial lines after the North-Eastern are the Lancashire and Yorkshire, which had a revenue of £3,802,897 in 1882, and the Manchester, Sheffield, and Lincolnshire, with a revenue of £1,964,285. The two great Scottish lines are the Caledonian and the North British—the former with 867 miles open, and an income of £2,989,429, the latter with 997 miles, and £2,548,159 of income.

In the United States, the Vignoles, or flange-rail, or the foot-rail, as it has been designated, typified in fig. 10, Plate CLXVI., is almost universally used for railways, varying in weight from 67 lbs. to 70 lbs. per lineal yard, on a few of the leading lines to 30 lbs. per yard, on narrow-gauge lines. Fully 60 per cent. of the length is laid with rails of 56 lbs. per yard. The latest railway achievement is the construction of the Northern Pacific Railway, which makes a line of 1919 miles across the continent, between Lake Superior and the Pacific Ocean at the city of Portland, in the state of Oregon. The official driving of the last spike was performed on the 8th September, 1883. As to the engineering of the line, the wise course was adopted of making the line cheaply at first. In a wilderness or desert, where there were no habitations, almost all the bridges were constructed of timber, some of them, through the Rocky Mountains, extraordinarily high. One such bridge is 226 feet high and 860 feet long, over a valley with steep sides. It is only wide enough for a single line, and, in crossing it, the depth seems tremendous. In constructing the line, blasts of enormous proportions were put in. In one instance ten tons of gunpowder were fired at once in the face of a cliff, which brought down 140,000 cubic yards of rock.

With regard to the weight and number of trains run an examination of the development of the traffic of the London and North-Western Railway, for example, shows us that in the earlier stages of development, whilst yet the line was free and unburdened with business, the number of trains was freely increased to conduct the growing traffic, with a small increase in their weight, but that subsequently, as the line became crowded with trains, and the circulation of traffic embarrassed, the number of trains was much more slowly increased, whilst considerable additions were made to their weight, so much so, that the whole train-weight, indicating the general magnitude of the traffic, has increased in an accelerating ratio since 1848. Meantime the pressure exerted upon the resources of the railway by the mixing of slow with fast trains has driven the London and North-Western Railway Company to the expedient of working the majority of their slow or goods trains during the night, when the road is comparatively clear. Thus, from a statement of the number of trains that passed one of their stations on the main line, we find that nearly half the whole number of goods trains were run between midnight and 6 A.M., and that the busiest periods of the twenty-four hours were after mid-day and after midnight, so equally and unavoidably was the traffic distributed over the day and night—the stupendous machine being in ceaseless operation, working double turns.

The number of trains that enter and leave some of the great stations in the course of a day is almost incredible; for example, on 15th August, 1870, 652 trains entered and left the Cannon Street station of the South-Eastern Railway between 6 A.M. and midnight, carrying about 40,000 passengers. Again, the Metropolitan District Railway, having a terminal station in the city of very limited accommodation, with but three lines of rail, sends out and receives at the station 460 trains daily.

Railway Speeds and Performances.—If an engine and tender, weighing together 32 tons, and exerting a given tractive force, takes say forty loaded carriages, weighing 290 tons, at 20 miles per hour on a level, the loads which it could take if it exerted the same tractive force at higher speeds would be only as follows:—

On a Level.

At 20	miles per hour,	40	carriages,	weighing	290	tons.
,, 30	,,	,,	30	,,	,,	220	,,
,, 40	,,	,,	21	,,	,,	160	,,
,, 50	,,	,,	15	,,	,,	115	,,
,, 60	,,	,,	11	,,	,,	85	,,
,, 70	,,	,,	8	,,	,,	60	,,

The influence of gradients also is very important. If an engine and tender, weighing together 32 tons, be capable of drawing a maximum train of say fifty-six loaded carriages, weighing 420 tons, at 20 miles per hour on a level, it would only draw the following loads at the same speed on the following inclines:—

At 20 Miles per Hour.

Level, ...	56	carriages,	weighing	420	tons.
Incline, 1 in 600,	45	,,	,,	340	,,
,, 1 in 300,	36	,,	,,	270	,,
,, 1 in 150,	27	,,	,,	200	,,
,, 1 in 100,	20	,,	,,	150	,,
,, 1 in 75,	16	,,	,,	120	,,
,, 1 in 50,	12	,,	,,	90	,,
,, 1 in 40,	9	,,	,,	65	,,
,, 1 in 30,	6	,,	,,	45	,,
,, 1 in 20,	3	,,	,,	24	,,
,, 1 in 10,	nil	,,	,,	nil	,,

It is here shown that on an incline of 1 in 20 the engine would only be capable of taking up three loaded carriages, about 24 tons weight, and that on 1 in 10 its whole power in this particular case would be absorbed in pulling up its own weight. Hence the prime importance, in the early stages of railway experience, of constructing the gradients as nearly level as was practicable, as they absorbed, according to their steepness, large proportions of the power of the light engines of the time in ascending hills; and that which would otherwise appear unwarrantable—the costly construction of the early railways by expensive tunnelling, viaducts, bridges, and cuttings to approximate to the desiderated horizontal standard—is abundantly explained by the paramount necessity of usefully employing the limited power of the engines then constructed. This was the stand-point of the elder

Stephenson; he maintained the superiority of 'flat' gradients, and the sound policy of incurring a large expenditure in construction, in order to avoid otherwise heavy inclines and heavy expenses. The ruling gradient of the Liverpool and Manchester Railway was fixed at 1 in 900, excepting of course the inevitable inclines at Rainhill summit, for working which special provision was made. That of the next great line, the London and Birmingham, was fixed at 1 in 330; and it is well known at what cost even this gradient, though considerably steeper than the Liverpool and Manchester, was obtained. It was the object of Mr. Stephenson to make this railway as mechanically perfect as possible, reducing the gradients to the minimum consistent with the conformation of the country. On the Great Western Railway, one of the earliest made lines, the ruling inclination is 1 in 1320 for the greater part of the way. Mr. Joseph Locke initiated the system of cheaply-constructed railways, as the facilities for increasing the power of locomotives became better understood; he constructed lines with long, steep gradients, some of them 1 in 70, 1 in 75, 1 in 80. The Great Northern Railway, of comparatively recent origin, is constructed on a ruling gradient of 1 in 200; and in general the more recently made lines have the steepest gradients. Following thus the variable surface of the country, this system became known as the 'undulating system,' and it has even been deemed preferable to the system of perfect or approximate levels, being supposed to afford breathing intervals, as was thoroughly understood in coach-driving, when the horses were eased by 'getting the shoulder off the collar' going downhill.' The analogy is not sound; an engine never tires, and its power does not necessarily fluctuate like horses' power.

Miles run by Trains and Rolling Stock.—The total mileage of trains for Great Britain and Ireland in 1882 was as follows:—

England and Wales,	217,393,015	miles.
Scotland,	29,041,855	,,
Ireland,	11,528,589	,,
United Kingdom,	257,963,459	,,

This extraordinary performance of trains in a single year is equivalent to the running of a railway train over 10,000 times round the world. The rolling stock required to do this work consisted of 14,128 locomotives and 452,061 carriages and waggons; and the cost for locomotive power and carrying stock amounted to 10¾*d.* per mile run by trains. The total expenditure of all kinds per train-mile amounted to 31½*d.* as against the gross receipts, which amounted to 59½*d.*

Working Speeds of Passenger Trains.—The average speed of express trains, including stoppages, varies from 36 to 42 miles per hour, and of parliamentary trains, stopping at all the stations, the average speed, including stoppages, varies from 17 to 21 miles per hour. The speeds of ordinary trains are intermediate between those of express and parliamentary trains, dependent on the frequency of the stoppages.

If the delays incurred by stoppages be allowed for in bringing up express trains and in getting up the speed, for which four minutes per stoppage may be allowed, and also the time standing at stations, the average speed, while running with steam on, would vary from 42 to 48 miles per hour. The average full speed on the Great Northern Railway (narrow gauge) is 47 miles per hour, and a speed of 62 miles per hour is frequently run. During periods of active competition the trains on the Great Western Railway (broad gauge) have been run at a speed of 65 miles per hour. But such a high speed can only be run, with any pretension to safety, on the best parts of the lines, free of curves, and with the road in first-rate order. The average practice in speeds of passenger trains appears to be the same on the broad and the narrow gauge.

Working Speeds of Goods Trains.—The ordinary average progress of goods trains, including all detentions, varies from 10 to 18 miles per hour over long distances. The ordinary actual speed while running varies from 15 to 25 miles per hour; 20 miles per hour is a common running speed. The very large goods traffic of the London and North-Western and Great Northern Railways is conducted at higher than average speeds in order to clear the passenger traffic —15 to 20 miles per hour, including stoppages, and frequently at a running speed of 30 to 35 miles per hour, or occasionally 40 miles per hour when the stoppages are long.

A goods engine, working at full power, exerts a tractive force of 10,000 to 12,000 lbs., or about 5 tons pull on the train; so that a pull of 5 tons from the engine suffices to draw behind it 1000 tons on a level.

A tractive force of 10 or 12 lbs. is capable of drawing 1 ton on a level at 10 miles per hour. At 60 miles per hour the required tractive force is about 45 lbs. for 1 ton of gross weight.

Railway Accidents.—Every year a number of accidents, attended with loss of life or bodily injury, take place on the railways. That they can be altogether avoided no one will maintain so long as humanity is weak and liable to error; but those best qualified to judge have no hesitation in saying that they may be greatly diminished. In fact they have diminished considerably since 1847, the proportion of passengers killed from causes beyond their own control in the three years 1847–49 being 1 in 4,782,188 of the total number carried; and in 1876, 1 in 10,802,324. It should be stated also that the number of passenger journeys on which this calculation is based does not include those of season ticket-holders. In 1876 these were estimated at 101,000,000, and if these were taken into account the proportion given would be reduced to 1 in 16,800,000. The comparatively small number of lives that are lost on the railways, indeed, in the midst of such an enormous traffic, is a fact that says a great deal for the general good management of the lines, and proves that on the whole there is no kind of vehicle safer than the railway carriage. As to the causes of the accidents a general review shows that the chief are want of care or mistakes of officers or servants, alone or in combination with defective signal and point arrangements, and want of telegraphic communication or of a system of securing intervals of space between trains. To these must be added defective regulations, or defective discipline, foggy weather, defective accommodation for traffic, defective construction, insufficient brake-power, &c.

As the best means of preventing accidents from defective signalling, the board of trade's inspectors of railways strongly advocate the adoption of the block system of working the signals, already described in the paragraph on signals; and there is no doubt that this system conduces very materially to the safety of a line, and inspires great confidence into the men whose duty it is to work the traffic. Indeed the metropolitan lines and other lines of crowded traffic could not be worked safely a day without such a system. During fog the telegraph apparatus is of inestimable utility in conjunction with the use of fog-signals, which are fixed to the rails, and discharged with a loud report by the engine in passing over them. As a farther means of avoiding accidents the interlocking of signals and points, already described, has been of essential service. In the present condition of railways, with junctions of great and constant traffic, and trains continually

crossing each other in all directions, the signal-men could not in some cases work safely for a single hour without the protection of such apparatus; while they are enabled by its aid to go on working from year to year without accident in the most difficult situations, as, for instance, at the Charing Cross and Cannon Street stations of the South-Eastern Railway. Perfect brakes are also indisputably promotive of safety in working traffic and in compensating for unavoidable irregularities. With the usual amount of braking power a train at 50 miles per hour may not be stopped within 900 or 1200 yards. An instantaneous brake is not of course what is wanted; on the contrary, a length of 150 yards appears to be the shortest desirable space within which a train at 50 or 60 miles per hour should be stopped so that the process of retardation should not be accompanied by the risk of carriages overriding each other or of violence to the passengers; and this has been accomplished by means of several systems of brake, in which the braking action is applied to each carriage. By means of the Westinghouse brake, a continuous brake of this kind which has the further advantage of being automatic or self-applying when the couplings of the carriages happen to give way, it has been ascertained that a train running at 60 miles an hour can be safely and certainly brought to rest in less than 200 yards. Some interesting results were arrived at by experiments with brakes made on the London, Brighton, and South Coast railway. The most important of these was that the greatest retardation of a train is produced when the wheels are revolving, but at a rate less than that which would correspond with the movement of the train; and that as soon as the wheels begin to skid the train glides onwards with diminished resistance, and therefore goes further than it would have done if they had continued slowly to revolve, although it is brought to rest within a shorter time. A perfect brake should accordingly prevent skidding, and should therefore combine a high initial pressure with a contrivance for steadily reducing the pressure so as never entirely to stop the revolution of the wheel till the train is brought to a standstill.

The general adoption of a simple method of communication between the guard and the driver of a train in motion is a desideratum. There are various plans for accomplishing this obvious and sufficient enough, but it would appear that, to insure their adoption by all railway companies, legislative interference must be invoked.

Railways of the World.—After the introduction of railways into Britain other countries were not long in following its example, the first of the European states which constructed a complete system of lines being Belgium. Europe is now traversed by railways in all directions; and even such a backward country as Turkey has two or three short lines opened for traffic, and an extensive net-work projected and partly in construction. Of the countries of Asia Hindustan is the only one that possesses railways of any magnitude, though Turkey in Asia and the islands of Java and Ceylon have also availed themselves of the services of the locomotive. The British colonies in Australia and New Zealand; the Cape Colony and Natal in Africa; Canada, New Brunswick, and Nova Scotia in N. America all now possess their lines of railway. The first railway constructed in the U. States was opened in 1827, and that country now possesses a greater length of line than any single state in the world. The United States railways have been constructed at much less expense than those of the United Kingdom, which indeed have cost far more per mile than those of any country; but the former are inferior in solidity of construction, in the rate at which trains are run upon them, in their buildings and accommodation, and in their management and organization generally. They are mostly single lines, and are generally without fences. English enterprise and capital have had a great share in the construction of the railways of the world, and many foreign railways are to a great extent owned and managed by Englishmen.

The total mileage of railways open and working in the different parts of the British Empire at the end of 1882 was as follows:—

United Kingdom,			18,457 miles.
India,		10,317	
Ceylon,		178	
Dominion of Canada,		7530	
Jamaica,		25	
British Guiana,		21	
Trinidad,		38	
Australia	New South Wales,	969	
	Victoria,	1247	
	South Australia,	832	
	Western Australia,	92	
	Queensland,	800	
		3940	
Tasmania,		172	
New Zealand,		1287	
Cape Colonies,		1057	
Mauritius,		82	
Total of Colonial Empire,			24,674 miles.
Total in British Empire,			43,131 miles.

We compile from official sources the following tabular comparison of the railways in the principal countries of the world in 1855 and 1882:—

Country.	Length of Railways open for traffic. Dec. 31, 1855.	Dec. 31, 1882.	Number of square miles of territory for every mile of railway in 1882.
Belgium,	828	2,683	4·
Great Britain,	8,356	18,514	6·5
Switzerland,	129	1,800	8·7
Germany,	4,863	21,672	9·8
Denmark,	18	1,105	12·5
France,	3,436	18,023	11·3
Netherlands,	195	1,263	10·
Austro-Hungary,	1,758	12,334	19·7
Italy,	566	5,800	19·7
Spain,	275	4,942	41·
Sweden,	23	3,940	44·
Portugal,	22	1,000	36·
Roumania,	—	922	52·4
Russia in Europe,	649	14,308	135·8
Turkey in Europe (1879),	—	712	89·6
Norway,	42	971	125·
Greece,	—	58	4000·
Total Europe,	21,140	111,399	33·6
United States,	19,247	117,717	25·
Dominion of Canada,	—	7,530	461·
Mexico,	—	2,219	335·
C. America & W. Indies,	—	1,094	280·
South America,	—	7,316	951·5
British India,	156	10,317	83·
Java (Dutch),	—	3,500	15·
Algeria,	—	804	152·5
South Africa (British),	—	1,287	204·
Egypt,	—	942	419·
Australasia,	—	5,592	579·

The above does not include railway systems of a number of minor states. The total mileage of the railways of the world in 1882 was in round numbers 265,000 English miles.

RAIMONDI, Marco Antonio, usually called Marcanton, famous as an engraver of Raphael's works, was born at Bologna in 1475 or 1488. Little more is known of his life than that he studied under Raibolini. In 1509 he proceeded to Venice, where he engraved Albert Dürer's Life of Mary, and Life and Passion of Christ. About 1510 he was in Rome, where he at first employed himself in engraving after Dürer's wood-cuts, but was shortly after employed by Raphael to make engravings of his works, and thus give them a European circulation, as Dürer had given his. In this he was completely successful. The usual custom of the engravers of his time was

to copy not from the completed pictures but the draughts, and one of the most important services which he rendered was the perpetuating in this way of a great number of designs and draughts, which Raphael either never completed at all, or produced in a much altered form. After Raphael's death he engraved after Giulio Romano, Bandinelli, and others. Having engraved some plates after licentious drawings of the former artist, he was cast into prison by Pope Clement VII., and the impressions were suppressed. He was soon afterwards, however, not only released, but taken under the protection of the pope himself, from whom he also received employment. In 1527, on the taking of Rome by the Spaniards, he lost all his means, and returned in poverty to his native town. What afterwards became of him is unknown. Malvasia says that he was murdered.

RAIN, water dropping through the atmosphere. A mass of air in the atmosphere always contains some aqueous vapour, and if this air is cooled below a certain temperature, called the dew-point (which depends on the amount of vapour present), the vapour will condense into drops of water. This cooling may be due to radiation of heat to colder regions, or to mixture with colder masses of air. When air rises in the atmosphere to colder regions, or comes in contact with a cold part of the earth, or passes from equatorial to polar parts of the earth, its moisture tends to condense into rain. In considering the probable rainfall of a place we are concerned with its latitude, its elevation above the sea, its proximity to the sea, the laws affecting its seasonal variations, the prevailing winds, and the configuration of the surrounding surface. Humboldt estimates the average depths of rain falling annually in latitudes 0°, 19°, 45°, and 60° at 98, 80, 29, and 17 inches respectively, low latitudes having in general a heavy rainfall because of the greater evaporation in tropical regions, and the consequent formation of rain when the clouds due to evaporation get colder in the higher regions of the atmosphere. Hence also winds blowing from the equator are generally moist, and winds blowing to the equator are generally dry. The presence of forests tends to increase the rainfall (see METEOROLOGY), and the rain further encourages vegetation, so that a forest region tends to become more and more covered with vegetation, and an arid region remains arid. The influence of the seasons on rainfall is pretty regular in the tropics. Over the ocean the skies are clear where the trade-winds are blowing steadily, and heavy rain falls by day in the zone of calms; on land there is a regular alternation of dry and wet seasons. In the tropical winter the sky is clear, in spring it becomes moist, and in summer (the sun coming to the zenith) the rainy season sets in. Towards the equator, where there is a considerable interval between the two passages of the sun across the zenith, there are two rainy seasons. In monsoon regions, however, the alternation of dry and wet seasons depends on the winds. Beyond the tropics we have variable winds and variable rainfall. The air is very dry in the British Isles during an east wind, especially in spring. The greatest annual rainfall hitherto observed seems to be on the Khasia Hills, where it is 600 inches, 500 falling here during the seven months' continuance of the south-westerly monsoons. Buchan gives the following estimates of the rainfall in certain tropical places:—

Singapore	97 inches.	Georgetown	100 inches.
Canton	78 ,,	Barbadoes	72 ,,
St. Benoit	163 ,,	St. Domingo	107 ,,
Sierra Leone	87 ,,	Bahamas	52 ,,
Caraccas	155 ,,	Vera Cruz	183 ,,
Pernambuco	106 ,,	Ceara	60 ,,
Rio Janeiro	59 ,,	Maranhao	280 ,,

Doldrums of the Atlantic ..... 225 inches.

In Europe the rainfall is greatest towards the west. At Coimbra it is 123 inches; it averages 30 inches in France, and in the plains of Germany and Russia 20 inches. In the British Isles it is very variable, being 224 inches in Skye, 183 inches in Seathwaite, Cumberland, and varying from 20 to 28 inches in the eastern parts of England.

The form of water known as rain is generally exceedingly pure; it contains such gases as may be derived from the atmosphere—oxygen, nitrogen, and carbonic acid—particles of organic matter, and, in towns, of dust. Rain-water serves, to a certain extent, as a measure of the purity of the atmosphere; that collected in large towns often containing considerable quantities of sulphuric and hydrochloric acids. For a more detailed description of the various impurities of rain-water see the article WATER.

RAINBOW. Newton first properly explained the formation of the rainbow, by showing it to be due to the unequal refrangibility of elementary rays. A rainbow appears as a set of bands of colour which graduate into one another, and we can imagine each of these divided into very fine bands, such that the difference in colour between one of these thin portions and its neighbour is very small, and may be considered as occurring *per saltum* in going from one band to another. One such band may be considered as produced by a set of raindrops lying on the surface of

Fig. 1.

a circular cone whose vertex is the eye of the spectator, and whose axis is the line produced through the eye of the spectator from the centre of the sun.

Suppose a raindrop I A I′ (fig. 1) to be receiving parallel rays of homogeneous light coming in the direction S I. Suppose θ, the angle of incidence of any ray, as the axis of S I, θ' the angle of refraction, and μ the index of refraction for the particular light. The deviation for each of the refractions at I and I′ is $\theta - \theta'$, and for the reflection at A it is $\pi - 2\theta'$. Therefore total deviation,

$$D = \pi + 2(\theta - 2\theta') \quad \text{.....(1)}$$
$$\text{Sin. } \theta = \mu \text{ sin. } \theta' \quad \text{.....(2)}$$

See OPTICS.

It is at once found from these two equations, by means of the differential calculus, that there is one angle of incidence such that the emerging ray makes with the incident ray a greater angle than that included by any other pair of emerging and incident rays. This happens when sin. $\theta = \sqrt{\frac{4 - \mu^2}{3}}$. It is also found that a small beam in the neighbourhood of I will converge to a focus at A, and will emerge at I′ in a nearly parallel beam. This beam will be the brightest of all those reflected from the back of the drop, and is that from which the eye will receive

the impression of its particular colour. If we employ a different light, μ will be slightly different, and the path through the raindrop will be slightly different. When a beam of solar light falls upon a small area of the drop at I it is separated by refraction, and the separated sets of rays issue at another small area I′, the angle of divergence of any two colours being equal to the angle subtended by those colours in the rainbow at the eye of the spectator.

The indices for red and violet rays from air into water are $\frac{109}{81}$ and $\frac{108}{81}$, and it is easy calculating the angles subtended at the observer's eye by straight lines from the brightest points of these colours to the

Fig. 2.

centre of the bow. They are found to be 42° 2′ for the red and 40° 17′ for the violet.

The formation of the secondary bow is explained in a similar manner. In this case the rays undergo two reflections, as represented in fig. 2. In the secondary bow the colours occur in inverted order—that is, the red is nearest to the centre.

Rainbows are also produced by the sun shining on the spray of cascades. A broken rainbow mostly occurs from the field not being filled with falling rain, but it will also happen when the sun is invisible from part of the field. See Parkinson's Optics.

RAIN-GAUGE, or PLUVIOMETER, an instrument which measures the depth of the annual rainfall at any place of observation. In its commonest form it consists of a cylindric vessel closed at the top by a funnel-shaped lid, through a hole in the centre of which the rain falls. A narrow glass tube, rising outside the vessel from near the bottom, shows by the height of the water in it the height of the water in the vessel itself. A very simple rain-gauge, and one which answers all practical purposes, consists of a copper funnel, the area of whose opening is exactly 10 square inches. This funnel allows the rain to pass into a bottle, and the quantity of rain caught is ascertained by multiplying the weight in ounces by 0·173, which gives the depth in inches. As a rain-gauge is nearer the ground, it is found to indicate a greater rainfall. This is partly due to the cold raindrops getting larger in falling through the very moist air near the ground, and partly to the greater occurence of eddies about the gauge at greater heights. Hence when the rainfall at two places is to be compared, the gauges ought to be similarly situated.

RAINY LAKE, a lake in British North America, between Lakes Superior and Winnipeg, and forming part of the boundary between the possessions of Great Britain and the United States. It lies 1160 feet above sea-level, is about 40 miles long by 15 miles broad, receives the waters of numerous small lakes from the east and north-east, and empties itself by Rainy River, about 90 miles long, into the Lake of the Woods.

RAISINS are dried grapes. There are two methods of drying them. One is by cutting the stalks of the bunches, usually those containing the finest grapes, half through when ripe, and allowing them to shrink and dry upon the vine by the heat of the sun. The other method is by plucking the grapes from the stalks, and dipping them in a boiling lye of wood-ashes and quicklime, after which they are dried, and exposed to the sun upon hurdles of basket-work for about a fortnight. Those prepared by the former process are called *raisins of the sun* or muscatels, and are much finer than the *Lexias*, the term applied to the others. *Valentia* raisins are prepared by steeping them in boiling water, to which a lye of vine-stems has been added. *Corinthian* raisins or *currants* are obtained from a remarkably small variety of grape, called the *black* Corinth, which is peculiar to the Greek islands. Raisins are imported in large quantities from the south of Europe, and likewise from Egypt, Smyrna, and Damascus. Those from Asiatic Turkey are called *Sultanas*. The quantity of raisins imported into Great Britain in 1882 was 548,911 cwt., value, £1,027,820; and the quantity of currants 1,002,102 cwt.; value, £1,351,931.

RAIZEN, or RASCIANS, the name given by the Hungarians to several Slavonic tribes professing the Greek faith, and scattered over Servia, Slavonia, Lower Hungary, Moldavia, and Walachia.

RAJAH, or RÂJÂ, the hereditary princes of the Hindus, who, before the subjugation of the country by the Moguls, governed the various countries of Hindustan, as they still continue to do in some instances, though they are generally dependent on the Europeans. They formerly belonged to the caste of Kashatriyas, or military caste, but the title may now be held by a member of any caste. A superior title to that of rajah is maharajah (great king), reserved formerly for those kings of India who had others under their sovereignty.

RAJMAHAL, a town in Hindustan, province of Bengal, on the Ganges, 68 miles W.N.W. of Murshidabad, and 203 miles N.N.W. of Calcutta by railway. Its advantageous position early raised it to importance, and it was long the acknowledged capital of the Bengal and Bahar provinces. The removal of the British courts of justice to Bhagalpur has seriously affected its prosperity, and caused it to assume a dull and deserted appearance; but it is still a large town, with no fewer than twelve market-places, the remains of a splendid palace, and an important transit trade. It was taken possession of by the British in 1763, and ceded to the East India Company by Shah Alum in 1765. Pop. about 30,000.

RAJMAHENDRI, a town in Hindustan, capital of the Godavari district, and seat of the principal court, is on the east bank of the Godavari, just above its subdivision into two arms, 40 miles from the sea, and 65 miles north-east of Masulipatam; lat. 16° 59′ N.; lon. 81° 54′ E. It stands on elevated ground, and consists of a principal street half a mile in length, and many narrow lanes running from it on either side, the whole lined by mean houses of mud and tiles, interspersed with some large dwellings of Zemindars, who are chiefly Brahmans. At its northern end is the fort, containing the barracks, hospital, jail, and magazine, and garrisoned by two companies of a native regiment. Mohammedans are few and poor in both the town and district; but here are numerous mosques, attesting their former wealth and numbers. Pop. (1881), 24,555.

RAJPUTANA, a large province of India, in the west part of Hindustan proper, extending from the Jamna and Chambal Rivers, west to Sind and Bhawalpur, and comprising the greater part of the Indian Desert. It is subdivided into a number of states, which are subsidiary to the British, and comprised under the seven following assistant political

agencies: Meywar, Jaipur, Marwar, Haraoti, Eastern States agency, Alwar, and Sirohi; together with the British districts of Ajmir and Mairwara. The total area of the native states is 129,750 English square miles; or including the British districts of Ajmir and Mairwara, 132,461 square miles. The maharajahs and rajahs are supreme in their own states, and settle disputes among themselves in courts of their own. A great portion of the surface of Rajputana is desert, and part of it wholly destitute of inhabitants, water, and vegetation. The whole of the soil is remarkably saline, containing many salt springs and salt lakes, and much of the well-water is brackish. In many places it is covered with the cactus and other prickly shrubs, but except in the hilly parts the territory is almost destitute of trees. The Rajput nation is said to be a branch of the Kshetriyas, one of the four great castes into which the Hindus were originally divided. They are essentially a military people, and many of their institutions bear a strong resemblance to the feudal customs which prevailed in Europe in the middle ages. They have likewise been celebrated for their chivalrous spirit, so unlike the effeminacy and duplicity of many of the oriental nations; but they are also unfortunately open to one or two revolting charges, which it is impossible even for their greatest admirers to deny. The darkest of these is the practice of female infanticide, which at one time was horribly prevalent, and has only of late years been suppressed by the powerful aid of British influence. The profuse use of opium has likewise in many cases produced a lamentable deterioration in their physical and moral state. Notwithstanding these serious drawbacks the Rajput character contains much that is noble and generous, and considering the beneficial effects which have already resulted from their connection with Britain, a much greater improvement may warrantably be looked for in the course of time. The Rajputs became first connected with the British government under the governorship of the Marquis of Wellesley, in the beginning of the present century. Pop. of native states (1881), 10,268,392.

RAKE, a term applied to the deviation of the masts from the vertical line of position, reckoned from the keel forward or aft; also applied to the projection of the upper parts of a ship, at both ends, beyond the extremities of the keel.

RAKE, an implement of husbandry, consisting of a bar of wood or iron having wooden or iron teeth inserted into it, and attached to a long handle. The wooden rakes are used principally in the fields for raking together or collecting hay, straw, &c. Iron rakes are indispensable in gardens, for smoothing the surface of the soil and the like. Rakes are sometimes adapted so as to be drawn by horses. In England an implement called the *ell-rake*, having a triangular frame for a handle and curved teeth, is much used in hay-fields.

RAKING, the act of cannonading a ship on the stern or head, so that the balls range the whole length of the decks, which is one of the most dangerous incidents that can happen in a naval action. This is frequently called *raking fore and aft*, and is similar to what is termed by engineers *enfilading*.

RAKOCZY, a famous princely family, now extinct in the male line, which for some time ruled the principality of Siebenbürgen or Transylvania, and by maintaining the civil and religious rights of the inhabitants made itself equally serviceable to them and formidable to the house of Austria. The first prince of the name was SIGISMUND RAKOCZY, who obtained the government in 1606, but resigned it in 1608 in favour of Gabriel Bathori.—GEORGE, son of the former, was, after the death of Bathori and Bethlen Gabor, restored to his principality in 1629, leagued with the Swedes during the Thirty Years' war, and in 1645 obtained for those of his subjects who, like himself, had embraced Protestantism, a peace which gave them back more than ninety churches that had been wrested from them, and numerous lost privileges.—He died in 1648, and was succeeded by his son, GEORGE II., who, failing in his attempt to be elected to the throne of Poland, vacant through the death of Casimir V., entered into an alliance with the Swedes, and invaded Poland at the head of a large army; but was completely defeated by the Poles, aided by the Austrians, on July 16, 1657. Abdicating in 1658, in consequence of the action of the Porte, he shortly afterwards contrived to regain his authority, but was soon forced from his position, and died in 1660. His son FRANCIS was implicated in a plot against the imperial government of Austria, and but for the intervention of his mother would have paid for his complicity with his life. In the latter years of his life, which terminated in 1676, he compiled a book of prayers, Officium Racoczianum, which obtained a wide circulation.—FRANCIS LEOPOLD RAKOCZY, prince of Siebenbürgen, and son of the preceding, after the Emperor Leopold I. had subdued it in 1689, lived as a private man on his own estates, but having, in consequence of fruitless negotiations with Louis XIV. of France, been arrested, was thrown into prison. He made his escape in 1701, and, bent upon revenge for the sentence of condemnation which had been passed upon him, determined to free Hungary from Austrian domination. He was soon at the head of 100,000 malcontents, and as the emperor, in consequence of the Spanish war of Succession, was unable to bring any effectual force against him, pillaged the greater part of Hungary and Moravia, took many fortresses, and suddenly advanced almost to the gates of Vienna. Leopold would now gladly have made peace, but could not make up his mind to agree to Rakoczy's stipulations—to convert Hungary into an elective monarchy, to give full toleration to all forms of religion, to confirm Rakoczy himself as Prince of Siebenbürgen, and to restore to him and his followers all the lands of their fathers. The victory of Marlborough and Prince Eugene at Blenheim enabled the emperor to bring a greater force against Rakoczy, who had not yet been able entirely to conquer Transylvania. During the preparations the emperor died in 1705, but his son and successor, Joseph I., succeeded, by the mediation of Holland and England, in making peace with the malcontents. Rakoczy refused to accede, and Austria commencing the war with renewed vigour gained many signal advantages. Rakoczy's former good fortune appeared to have forsaken him. An attempt to engage the Turks in his cause failed; the plague began to rage among his troops; a visit to Poland, where he endeavoured to gain Peter the Great, also failed; and the Hungarians, taking advantage of his absence, concluded a separate peace, and Rakoczy was glad to come to any terms. He retired to France, and afterwards to Roumelia, where he died in 1735. He left Memoires sur les Revolutions de Hongrie, which display much talent.

RAKOCZY MARCH, a simple yet stirring march by an unknown composer, and a very favourite one with the army of Francis Rakoczy II. In the war of 1848 and 1849 it was adopted by the Magyars as their national march, and is said to have had as inspiriting an effect upon them as that exercised by the Marseillaise on the French. Like that one it also was opposed by the government, the Austrians having made various attempts to suppress it. A weak paraphrase of the march was made in 1824, and in

this form it is most generally known in Germany and elsewhere.

RALEIGH, a city in the United States, capital of North Carolina, 135 miles S.S.W. of Richmond in Virginia, on the North Carolina Central Railway. It is regularly and neatly laid out, containing a large and four smaller squares; and has a state-house, a massive granite structure after the model of the Parthenon, 166 feet long, 90 feet wide, and surrounded by massive columns of granite, 5½ feet diameter, and 30 feet high, and surmounted by a beautiful dome; a court-house, jail, governor's house, a theatre, a market, churches of various denominations, several academies and schools, a deaf and dumb institution, three banks, two foundries, a carriage factory, and a considerable trade. Pop. (1880), 9265.

RALEIGH, or RALEGH, SIR WALTER, a distinguished warrior, statesman, and writer in the reigns of Elizabeth and James I., was the second son of a gentleman of ancient family in Devonshire. He was born in 1552 in that county, and was sent to Oriel College, Oxford, where his proficiency gave a high opinion of his capacity. His active disposition and martial ardour led him, at the age of seventeen, to join a body of gentlemen volunteers raised to assist the French Protestants. He subsequently accompanied the forces sent under General Norris to assist the Dutch, and afterwards accompanied his half-brother, Sir Humphrey Gilbert, in a voyage to Newfoundland. On his return in 1580 he distinguished himself in the Irish rebellion, and was rewarded for his services by a considerable estate in Ireland. His favour at court was advanced by a well-known act of gallantry. The queen, in a walk among a crowd of courtiers, having come to a spot in which the path was obstructed by mire, Raleigh immediately took off his rich plush cloak and spread it on the ground for a foot-cloth. In 1584 his active disposition was manifested in a scheme for the discovery and settlement of those parts of North America not already appropriated by Christian states. By his interest he obtained a very extensive patent for this purpose; and with the help of friends two ships were fitted out. These vessels having carried home cargoes that sold well, a second expedition of seven vessels followed, under the command of Sir Richard Grenville, Raleigh's kinsman. The latter enterprise terminated in the settlement of Virginia, so called in honour of Queen Elizabeth. To this expedition is also due, it is said, the introduction of tobacco and the potato-plant into Europe. In the meantime he was honoured with knighthood, and rewarded by several lucrative grants, including a large share of the forfeited Irish estates. He was one of the council to whom the consideration of the best means of opposing the Spanish armada was intrusted, and was among the number of volunteers who joined the English fleet with ships of their own. In 1589 he accompanied the expelled King of Portugal in his attempt to reinstate himself, for which service he received several additional marks of favour and emolument; for although fond of glory, he was almost equally so of gain. On his return from Portugal he visited Ireland, and contracted an intimacy with Spenser, who celebrated Sir Walter under the title of the Shepherd of the Ocean, and to his Faery Queen prefixed a letter to him explanatory of its plan and design. The latter, in return, introduced the poet to Elizabeth. In 1592 he commanded an expedition with a view of attacking Panamá; but was recalled by the queen, and soon after incurred her displeasure by an amour with one of her maids of honour, the daughter of Sir Nicholas Throckmorton. Although he made the best reparation in his power, by marrying that lady, he was imprisoned for some months, and banished the queen's presence. To recover favour he planned an expedition to Guiana, in which he embarked in February, 1595, and reached the Orinoco; but was obliged by sickness and contrary winds to return, after having done little more than take a formal possession of the country in the name of Elizabeth. In 1596 he had so far regained favour that he had a naval command under the Earl of Essex, with whom a difference ensued that laid the foundation of a lasting enmity between them. Sir Walter was subsequently fully restored to the good graces of Elizabeth, who nominated him to the government of Jersey. He witnessed the ruin of his antagonist, the Earl of Essex, whose execution he urged, and personally viewed from a window in the armoury. The speedy death of the queen, which this very catastrophe hastened, put a period to his prosperity. James I., whom, with some other courtiers, he sought to limit in his power of introducing the Scots into England, resented that attempt, and disliked him as the enemy of his friend the Earl of Essex. Although received with external civility at court, he was deprived of his post of captain of the guards, and evidently discountenanced. This treatment preyed upon his high spirit; and a conspiracy having been formed for the purpose of placing upon the throne the Lady Arabella Stuart, Sir Walter was accused of participating in it by Lord Cobham, to whose idle proposals he had given ear without approving them. He was brought to trial in November, 1603, and by the base subservience of the jury was declared guilty of high treason, even to the surprise of the attorney-general Coke himself, who declared that he had only charged him with misprision of treason. Raleigh was reprieved, and committed to the Tower, where his wife, at her earnest solicitation, was allowed to reside with him, and where his youngest son was born. Though his estates in general were preserved to him, the rapacity of the king's minion, the infamous Carr, afterwards Duke of Somerset, seized on his manor of Sherborne, upon a flaw found in Raleigh's prior conveyance of it to his son. It was not until January, 1616, after twelve years' confinement, that he obtained his liberation, during which interval he composed the greater part of his works, and especially his History of the World. He was only released at last by the advance of a large sum of money to the new favourite Villiers, and to retrieve his broken fortunes he planned another expedition to America. He obtained a patent under the great seal for making a settlement in Guiana; but, in order to retain a power over him, the king did not grant him a pardon for the sentence passed upon him for his alleged treason. How far Raleigh knowingly deceived the court by his representations of rich discoveries and gold mines it is impossible now to ascertain; but having reached the Orinoco, he despatched a portion of his force to attack the new Spanish settlement of St. Thomas, which was captured with the loss of his eldest son. The expected plunder, however, proved of little value; and Sir Walter, after having in vain attempted to induce his captains to attack other Spanish settlements, arrived at Plymouth in July, 1618. In the meantime the Spanish ambassador had produced such an effect upon James, who was seeking the hand of the Infanta for his son Charles, that Raleigh was arrested and committed to the Tower. James had reason to be offended with the conduct of Raleigh against a power in amity with himself, and might have tried him for this new offence; but with his usual meanness and pusillanimity determined to execute him on his former sentence. Being brought before the Court of King's Bench, his plea of an implied pardon by his subsequent command was overruled; and the doom of death being pronounced against

him, it was carried into execution the following day (October 29, 1618), in Old Palace Yard. His behaviour at the scaffold was calm; and after addressing the people at some length in his own justification, he received the stroke of death with perfect composure. As a politician and public character Raleigh is doubtless open to much animadversion; but in extent of capacity and vigour of mind he had few equals, even in an age of great men. His writings are on a variety of topics, poetical, military, maritime, geographical, political, and historical. Most of his miscellaneous pieces have ceased to be interesting, but his History of the World is one of the best specimens of the English of his day, being at once the style of the statesman and the scholar. The compass of the work did not admit fulness of narrative, but he is often an acute and eloquent reasoner on historical events. The best edition is that of Oldys (1736, two vols. folio). Of his miscellaneous works an edition by Dr. Birch was published in 1748, in two volumes octavo. Lives of Raleigh have been written by William Oldys, Arthur Cayley (1806), Mrs. A. T. Thomson (1830), P. F. Tytler (1833), J. A. St. John, and Edward Edwards (both two vols. 1868).

RALLENTANDO, also RITARDANDO, or LENTANDO (Italian), in music, indicates that the time of the passage over which it is written is to be gradually retarded.

RAM, a steam ship of extraordinary strength and solidity, and propelled by powerful engines, used as an instrument of war. Its distinctive character is derived from the beak at its prow. This beak consists of a solid or nearly solid piece of iron, or wood armed with iron, fixed to the prow below the water line; it is flat underneath, and tapers towards its outer extremity nearly to a point. The vessel itself is otherwise constructed like the ordinary iron-clads, and may either have its battery broadsidewise or in revolving turrets. The beak is usually constructed as an independent adjunct to the ship, so that in the event of any serious collision it may be left buried in the hostile vessel, or if carried off in any other way may not occasion any injury to the vessel itself. The modern iron-clad ram was first used during the late civil war in America. In 1862 the ram *Merrimac*, belonging to the Confederates, destroyed with the utmost ease several of the Federal wooden vessels lying in the Hampton Roads. See IRON-CLADS.

RAM, BATTERING. See BATTERING-RAM.

RAMADAN, the ninth month in the Mohammedan year. It is devoted to fasting and abstinence. From sunrise to sunset for the thirty days of its duration the Mohammedans partake of no kind of nourishment. Eating, drinking, smoking, bathing, and all other bodily enjoyments, are absolutely interdicted. If a pious Mohammedan passes in the street an unbeliever having a cigar in his mouth he carries his hand to his mouth that there may be no possibility of a particle of the smoke entering. But whenever the sun disappears under the horizon all restriction is removed, and an immediate onslaught is made upon the viands. The cafés are filled, and the revels frequently continue throughout the whole night. The Mohammedan month being lunar there is no fixed period at which Ramadan occurs, and when it happens during the long hot days of midsummer the observance of the fast is particularly trying. In this case exemption is made in favour of those to whom it would prove really injurious, such as nurses, pregnant women, and others. At the termination of the month a great feast takes place, called *beiram*, and all labour ceases for a period of three days, during which they give themselves up to all manner of table enjoyments. The reason for the observance of the month Ramadan as a fast is that in it Mohammed received his first revelation. The principal passages in the Koran referring to the fast of Ramadan are to be found in the second Surah.

RÂMÂYANA. See SANSKRIT LANGUAGE AND LITERATURE.

RAMBERG, JOHANN HEINRICH, distinguished for his paintings and etchings, was born in 1767 in Hanover. He first showed his talent by drawings of scenes in the Hartz Mountains. These drawings became known to the King of England, his sovereign as Elector of Hanover, who induced him to come to London, where he provided for him. He remained there nine years, and perfected himself under Reynolds. Murphy, Bartolozzi, and other engravers of the first rank in England, engraved drawings of his. In 1788 the king sent him to Italy, whence he returned to Hanover, where he was appointed painter to the court. Few painters and designers have produced so many works as he has; but this rapidity prevented the full development of his talent. Ramberg distinguished himself particularly in the humorous caricature. The drawings to the magnificent edition of Wieland's works are all by him; some he etched himself.

RAMBOUILLET, a town of France, in the department of Seine-et-Oise, in a beautiful valley near the extensive forest of same name, 27 miles southwest of Paris. It has good houses, and regular, spacious, well-cleaned streets, but is, on the whole, a dull place; remarkable only for its château, long the residence of the kings of France, and a fine park, in which the first model farm in France was established; and for its sheepfold, which was the first depot of Merino sheep brought to France from Spain by Napoleon. From this flock have sprung the pure race and the mixed races of sheep, which constitute one of the greatest sources of wealth in the country. Shortly after the investment of Paris, on Oct. 4, 1870, a combat took place here between the French and Germans, in which the former were vanquished, and the town remained in the hands of the Germans till the conclusion of peace. Pop. (1881), 5186.

RAMBOUILLET, CATHERINE, MARQUISE DE, one of the most remarkable women of the seventeenth century, was born at Rome of Italian parents in 1588, and educated with great care by her mother. In 1600, when only twelve years old, she married Charles d'Angennes, son of the Marquis de Rambouillet, to whose title and estates he succeeded on the death of the latter in 1611. When the marquise appeared at the French court she was much shocked at the flagrant corruption of manners reigning there, and as her refined tastes did not permit her to derive any enjoyment from the mob of courtiers who assembled in the Louvre she conceived the idea of creating a select circle for herself. Her high rank, conjoined to her personal merits, made the execution of her design a comparatively easy matter. She caused the famous Hôtel de Rambouillet to be constructed after plans of her own, and soon had the satisfaction of seeing herself the centre of some of the most illustrious persons, in respect both of genius and rank, in the kingdom. Handsome and gracious, but free from coquetry and all personal pretensions, Madame de Rambouillet was admirably fitted to preside over these literary reunions, destined to become so famous. Her affability, generosity, and devoted attachment to her friends made her the idol of almost all who enjoyed her society. The writers of the period, too, are unanimous in the expression of her homage, which may be traced to the fact that among her other merits she possessed that of comprehending the true spirit of the society of the time. At her house might be observed the interfusion of the aristocracy of genius with the aristocracy of birth; the humblest man of

letters there met on terms of perfect equality with the highest nobleman in the land, so equitably did she exercise her patronage of letters. For more than fifty years this *salon* remained open, during which period more than one generation of distinguished men frequented it. At first it was Malherbe and Racan, followed by that illustrious circle of *beaux esprits* who contributed so much to the formation of the French language and taste—Costar, Sarrazin, Conrart, Patru, Balzac, Segrais, Godeau, Voiture, and Corneille; and finally the generation who filled up the interregnum between Corneille and Molière, Scarron, Saint-Évremond, Benserade, La Rochefoucauld, and others. Nor was the reputation of the Hôtel de Rambouillet much less for the illustrious women who frequented it than for the men; considering we meet with such names as those of Mademoiselle de Scudéry, Mademoiselle Coligny, afterwards celebrated as the Comtesse de la Suze, and who, with the Marquise de Sablé, inspired the Maximes of La Rochefoucauld. In the midst of the circle of distinguished women, illustrious alike for her singular beauty and faultless grace of manner, and adored by all who knew her, shone Mademoiselle Bourbon-Condé, better known afterwards as the Duchesse de Longueville, the heroine of the Fronde. It has been thought by some that the Précieuses Ridicules of Molière was aimed at exposing some of the foibles of this society; but Molière himself protested against the supposition that he meant to reflect on a circle which he affirmed had every claim to respect. The hôtel exercised a beneficial influence as well upon the language as upon the manners of the time; and the name of the Marquise de Rambouillet is inseparably associated with the annals of one of the most important periods of French literature and French society. The declining years of the marquise were darkened by trouble, occasioned partly by the removal or death of some of her dearest friends, and partly by other causes; but her *salon* still remained open, and it was only after her death, which took place in 1665, that it was closed. See Roederer's Mémoire pour servir à l'histoire de la société polie en France pendant le dix-septième siècle; and Cousin's Jeunesse de Madame de Longueville, &c.

RAMEAU, Jean Phillippe, an able French theorist in the science of music, was a native of Dijon, and born in 1683. Having at an early age acquired some skill in music he joined a strolling company of performers, by whose assistance a musical entertainment of his composition was represented at Avignon, in the eighteenth year of his age. He was afterwards appointed organist in Clermont Cathedral, applied himself to the study of the principles of his profession, and in 1722 printed the first-fruits of his investigation in a treatise, entitled Traité de l'Harmonie. Four years after appeared his Nouveau Système de Musique Théorique, which was followed by his Génération Harmonique. In 1750 he published his celebrated Dissertation sur le Principe de l'Harmonie, in which he reduces harmony to one single principle—the fundamental bass, on which he proves all the rest to depend. This work procured him an invitation from the court to superintend the opera at Paris. He possessed a great facility in adapting words to music, and piqued himself so much upon this talent that he is said to have declared he would set a Dutch gazette if it was required of him. His remaining theoretical works are, Remarks on the Demonstration of the Principles of Harmony; Reply to a Letter of M. Euler (both printed in 1752); On the Instinctive Love of Music in Man (1754); On the Mistakes of the Encyclopædia with Respect to Music (1755); and a Practical Code of Music (1760). He was also the author of six operas, Hippolyte et Aricie, Castor et Pollux, Dardanus, Samson, Pygmalion, and Zoroaster, besides a great variety of ballets and other minor pieces. Louis XV. acknowledged his merits by the grant of a patent of nobility, and the order of St. Michael. Rameau died at Paris in 1764.

RAMEE, or Chinese Grass. See Boehmeria.

RAMESES, or Ramses (in Egyptian, 'the Child of the Sun'), the name given to several Egyptian kings, especially of the nineteenth and twentieth dynasties. A king of this name is sometimes mentioned as belonging to the eighteenth dynasty, and as having reigned about 1590 B.C., but his proper name was Rames, and he does not seem to have reigned independently.—Rameses I. was the first king of the nineteenth dynasty, and was not among the most remarkable of the series.—Rameses II., grandson of the preceding, and son of Seti (the Sethos of Manetho), was the third king of the nineteenth dynasty, and reigned from 1388 to 1322 B.C. He was one of the most notable of all the kings of Egypt, and is identified by many students of Egyptian history with the Sesostris of Greek writers. (See Sesostris.) His first achievement was the reduction of Ethiopia to subjection, which he accomplished in the beginning of his reign when he was still very young; but the great event of his reign was his war with the Khita, supposed to be the Hittites. He defeated a confederation among whom the Khita were the chief in a great battle near the Kadeshon (Orontes) in Syria, and in a subsequent stage of the war took Jerusalem and other places. He fortified the east of Egypt by erecting a great wall from Pelusium to Heliopolis, and he also constructed forts at Heroöpolis and Tanis. In his reign Thebes rose to great magnificence. In this city he erected the splendid temple known as the Rhamession, with a sitting statue of himself sixty feet high. He is supposed to have been the king who chiefly oppressed the Hebrews, and the father of Menephthat under whom the exodus took place.—Ramses III., the Rhampsinitus of Herodotus, belonged to the twentieth dynasty, and was also a king of some note, some of whose achievements seem to have been ascribed to Sesostris. His reign lasted from 1269 to 1244 B.C., during which period he had to withstand many invasions of the surrounding nations, but he was uniformly successful in war, and active in great undertakings in time of peace. At Medinet-Abu he built a magnificent temple in memory of his warlike achievements in Nubia and Syria.—Ten other kings of the name of Rameses are mentioned as having belonged to the twentieth dynasty, but none of them is of any great importance. The last of them is supposed to have completed his reign about 1000 years before the Christian era.

RAMESES, a city of Egypt, supposed to be the same as Raamses, one of the treasure-cities built for Pharaoh by the children of Israel during their bondage in Egypt. It was from this point that the Israelites set out in their exodus from Egypt; and its geographical position is therefore of great interest as determining their route towards the Red Sea. Various conjectures have been made as to its locality. Some have supposed it to be in the neighbourhood of On or Heliopolis; others somewhere near Old Cairo or ancient Babylon—and the latter is the old Jewish tradition; but Dr. Robinson places it in Wady Toumilât, somewhere towards the east end of that valley; and Dr. Lepsius thinks he has found its site at Aboo Kesheyd, or Kesheib, in that region. The conjecture, however, which seems to have the greatest degree of probability attaching to it is that which places it in the neighbourhood of Memphis. It is argued in support of this view that Rameses

must have been near the capital or residence of Pharaoh at the time of the exodus, to admit of the frequent interviews and immediate communications which took place between Pharaoh and Moses. On the last occasion Moses was sent for at midnight, and not only did the interview take place before the morning, apparently immediately, but the departure also from Rameses before daylight (Exod. xii. 42). Moses must therefore have been near at hand. The conclusiveness, however, of this argument, must depend upon the identification of Pharaoh's residence with Memphis. But for this there is the testimony of Herodotus, Diodorus, and all the ancient historians, who represent Memphis as the capital from the earliest times down to the reign of the Ptolomies. It is possible, however, that Pharaoh may have had a temporary residence elsewhere, and that he may have been there at the time of his interviews with Moses, but the likelihood of this is denied.

RAMILLIES, a village of Belgium, province of Brabant, 13 miles north of Namur and 28 south-east of Brussels. On May 23, 1706, the Duke of Marlborough gained here a signal victory over the French under Marshal Villeroi and the Duke of Bavaria. The numbers were about 60,000 on each side; the loss of the allies was 4000 men, that of the French 15,000. The consequence of this battle, the most important in the war of the Spanish Succession, was the immediate evacuation of Flanders by the French.

RAMMER is a cylindrical block of wood nearly fitting the bore of a cannon, and fastened on a wooden staff, or on a stiff rope well served with spun yarn. It is used to drive the charge of a cannon home, or to the innermost part of it. The rope-rammers are most general in ships of war.

RAMMOHUN ROY, an Indian rajah, who distinguished himself by his literary attainments, and his conversion from the ancient Hindu faith to a species of Unitarianism, or rather Arianism, was born about the year 1776, at Burdwan, in the province of Bengal. The first elements of his education he received under the paternal roof, where he also acquired a knowledge of the Persian language. He was afterwards sent to Patna to learn Arabic; and here, through the medium of translations of Aristotle and Euclid, he studied logic and mathematics. When he had completed these studies he went to Calcutta to learn Sanskrit, the sacred language of the Hindu scriptures, the knowledge of which was indispensable to his caste and profession as a Brahman. About 1804 or 1805 he became possessed, by the death of his father and of an elder and younger brother, of the whole family property, which is said to have been very considerable. He now quitted Burdwan, and fixed his residence at Murshidabad, where his ancestors had chiefly lived. Shortly after his settlement at this place he commenced his literary career by the publication of a work in the Persian language, with a preface in Arabic, which he entitled, Against the Idolatry of all Nations. The freedom with which he animadverted on their respective systems gave great umbrage both to the Mohammedans and the Hindus, and created him so many enemies that he found it necessary to remove to Calcutta, where he again took up his residence in the year 1814. Two years previously to this period he had begun to study the English language; but he did not then apply to it with much ardour or success. Being some years after appointed dewan, or chief native officer in the collection of the revenues, and the duties of his office affording him frequent opportunity of mixing with English society, and of reading English documents, he applied to it with increased attention, and very soon qualified himself to speak and write it with considerable facility, correctness, and elegance. He afterwards studied the Latin, Greek, and Hebrew languages. A careful study of the sacred writings of the Hindus had convinced him that the prevailing notions respecting the multiplicity of deities, and the superstitious devotion to the licentious and inhuman customs connected with them, were grounded upon a gross perversion of their religion. These original records appeared to him to inculcate a system of pure Theism, which maintained the existence of one God, infinite in his perfections and eternal in his duration; and that it required from its professors a mental rather than a corporeal worship, accompanied by strict and exemplary virtue. Having embraced these views of the Hindu theology and morals, he became anxious to reform the creed and practice of his countrymen, and determined to devote his talents and his fortune to this important and honourable undertaking. He translated the Vedanta, a compendium of the doctrines contained in the Vedas or ancient sacred books of the Hindus, from the Sanskrit into the Bengali and Hindustani languages, and distributed the translation gratuitously. This he afterwards published in English, for the purpose of proving to his European friends 'that the superstitious practices which deform the Hindu religion, have nothing to do with the pure spirit of its dictates.' But, as might be expected, his benevolent conduct and zeal for the good of his fellowmen exposed him to many personal inconveniences. He had, nevertheless, the gratification of witnessing the beneficial effects of his labours. From the perusal of the New Testament in his 'long and uninterrupted researches into religious truth, he found (he says) the doctrines of Christ more conducive to moral principles, and better adapted for the use of rational beings than any other which had come to his knowledge.' As the most likely method of acquiring a correct knowledge of these doctrines, he determined upon a careful perusal of the Jewish and Christian Scriptures in their original languages. From this undertaking he rose with a full conviction that the Christian religion is true and divine. In 1820 he accordingly published a work entitled the Precepts of Jesus the Guide to Peace and Happiness, consisting chiefly of a selection of moral precepts from the Evangelists. In this undertaking he was governed by the consideration that historical and some other passages are liable to the doubts and disputes of free-thinkers and anti-Christians, especially miraculous relations, which are much less wonderful than the fabricated tales handed down to the natives of Asia, and would consequently be apt at best to carry little weight with them. Rammohun Roy, in his doctrinal views, was a Unitarian, holding however, the pre-existence and superangelic dignity of Christ, and considering the doctrine of the Trinity as a species of polytheism, objectionable in itself, and calculated to prevent the adoption of what he considered the Christian faith by the natives of Hindustan. In 1833 Rammohun Roy visited England, in the character of ambassador from the King of Delhi, and while there was seized with a fever, which proved fatal. He died at Stapleton Grove, the residence of Dr. Lant Carpenter, near Bristol, on the 27th September of that year. When in the extremities of death he went through the rites of the Brahmanical religion, in order that his children might not lose their property and caste. For the same reason he was privately interred at Stapleton Grove, instead of a Christian cemetery. Compare Review of the Labours, Opinions, and Character of Rajah Rammohun Roy, by Lant Carpenter, LL.D.

RAMPANT, in heraldry, a term applied to a lion, leopard, or other beast, that stands on his hind legs, and rears up his fore feet, the one elevated

above the other in the posture of climbing, showing his face in profile only. If the head is so turned as to present a front view of the face while the posture otherwise remains the same, it is called *rampant-gardant;* and *rampant-regardant* if the head is turned so as to look backwards. *Counter-rampant* is rampant towards the sinister, the opposite of the usual attitude. *Rampant* is different from *salient*, in which the beast seems springing forward.

RAMPART. See FORTIFICATION.

RAMPHORHYNCHUS. See PTEROSAURIA.

RAMSAY, ALLAN, next to Burns the most distinguished among the modern Scottish poets, was born on the 15th of October, 1686, at Leadhills, in Lanarkshire. His father was superintendent of Lord Hopetoun's mines there, and his mother, Alice Bower, was the daughter of a gentleman in Derbyshire. All the education which Allan ever received was at his native parish school in Crawfordmuir, where it is probable he merely went through the common routine of instruction to be had at such seminaries. The death of his father in early life prevented him, it is to be supposed, from receiving anything like a liberal education, and forced him to seek, while yet a youth, a means of livelihood in the Scottish capital. There he became bound as an apprentice to a *wig-maker*—an occupation which the greater part of his biographers are very anxious to distinguish from a *barber*, but with what degree of justice we know not. Allan himself, it would seem, was not ashamed of his trade, but continued in it long after his apprenticeship had ceased; nor did he abandon it for the more congenial pursuit of bookselling, until he had held for some time a name in the poetical world. The exact period when he commenced bookselling we cannot ascertain; but he is said to have been the first who established a circulating library in Scotland. The library was extensive, and continued to exist till a comparatively recent period. His first shop, as we learn from the imprint of some of his books, was 'at the sign of the Mercury, opposite to Niddry's Wynd;' but in 1726 he removed to a house at the east end of the Luckenbooths, and instead of Mercury, adopted for his sign the heads of Ben Jonson and Drummond of Hawthornden. In 1720 he published a collection of his poems, in one volume quarto, which was so liberally subscribed for, that he is said to have cleared by it 400 guineas. The greater part of the pieces in this collection had previously appeared at different periods in the form of sheets or half-sheets; and so popular had their author become, that it was quite customary for the good people of Edinburgh to send their children with coppers for Allan Ramsay's last piece. In 1724 the first volume of The Tea-Table Miscellany, a Collection of Songs appeared, which was soon followed by a second and third volume. The rapid sale of this compilation induced Ramsay to publish another, entitled The Evergreen, being a Collection of Scots Poems wrote by the Ingenious before 1600, which was equally successful. His next publication established his fame upon a sure and lasting basis. In 1725 appeared The Gentle Shepherd—the best pastoral perhaps in any language. Its success was instantaneous and unprecedented; edition followed edition with great rapidity; and it was not long till it was known by every lover of poetry, and—what bespeaks a higher popularity—till it had taken a place on the shelf of almost every cottage in Scotland. In 1728 a second quarto volume of his poems appeared; and in 1730 his Thirty Fables, which concluded his public poetical labours. The Fables are undoubtedly the best of Ramsay's lesser productions. Among them stands The Monk and the Miller's Wife; a story which, although previously told by Dunbar, would, of itself, as a competent judge has remarked, be Ramsay's passport to immortality as a comic poet. He was now at the height of his celebrity: his acquaintance was courted by many distinguished individuals, and his shop was the common resort of the literary characters and wits of Edinburgh. In 1736 he took a principal part in the erection of a theatre in Carubber's Close, by which he came to considerable pecuniary loss; and it is remarked by his biographers, that this was perhaps the only unfortunate project in which he ever was engaged. In 1743 his wife died, to whom he had been married above thirty years; and soon after this, with the idea of relinquishing his shop, he built a house on the north side of Castle-hill, in rather a whimsical style of architecture. Here he spent the last twelve years of his life in a calm and pleasant manner; although he did not give up his shop until within three years of his decease. He died at Edinburgh on the 7th January, 1758, aged seventy-two; and was buried in Greyfriars' Churchyard, where a monument to his memory is erected. Another monument, erected in 1865, stands in Princes' Street Gardens. His son Allan, born 1709, died 1784, became famous as a portrait-painter, having studied in Italy under Solimena and Imperiali. In 1767 he was appointed principal painter to George III. His portraits are faithful, and free from affectation. He was also the author of several literary brochures, published under the title of the Investigator.

RAMSAY, ANDREW MICHAEL, better known by the name of the Chevalier Ramsay, was born in Ayr, in 1686. He was the son of a baker in opulent circumstances, who was able to give him a good education. After spending some time at the Universities of Edinburgh and St. Andrews, he went to Leyden, the university of which was at that time the common resort of the literary youth of Scotland. In 1710 he repaired to Cambray, on a visit to the celebrated Fénelon, who received him into his house as an inmate of the family, and by whom he was persuaded to embrace the Catholic faith. Fénelon's influence procured him the preceptorship to the Duke of Château-Thierry and the Prince of Turenne. He was afterwards engaged to superintend the education of Prince Charles Edward Stuart and his brother Henry, afterwards Cardinal York, and for this purpose he removed from Paris to Rome in 1724. Later in life he visited his native country, and offered to settle a handsome annuity on his relations, which they refused to accept, on the ground of his having renounced the Protestant faith. He died while residing with the family of Marshal Turenne, at St. Germain-en-Laye, on the 6th May, 1743. The Chevalier Ramsay, during his life, published several works, which give him a respectable place both in French and English literature. The chief of these are a Life of Viscount Turenne, a Life of Fénelon, the Travels of Cyrus, and a large work on the Principles of Natural and Revealed Religion.

RAMSDEN, JESSE, an eminent mechanist and optician, was born at Halifax in Yorkshire in 1735. He was the son of an innkeeper, and after receiving a fair education was apprenticed to a cloth-worker. Subsequently he applied himself to engraving, and in the course of his employment having to engrave several mathematical instruments, finally constructed them himself. He married a daughter of Dollond, the celebrated optician, and opened a shop in the Haymarket, whence he removed to Piccadilly, where he remained until his death in 1800. Ramsden obtained a premium from the board of longitude for the invention of a machine for the division of mathematical instruments. He also improved the con-

struction of the theodolite, the pyrometer for measuring the dilatation of bodies by heat, the barometer for measuring the height of mountains, &c.; also the refracting micrometer and transit instrument and quadrant. He made great improvements in Hadley's quadrant and sextant, reducing the limits of error from 5′ to 30″; and procured a patent for an amended equatorial. Ramsden, who was chosen a fellow of the Royal Society in 1786, and of the Imperial Academy of St. Petersburg in 1794, was distinguished during the whole of his life by an enthusiastic attention to his own profession; and such was his reputation that his instruments were bespoken from every part of Europe, and ultimately to obtain the fulfilment of an order was deemed a high favour. So early as 1788 no fewer than 983 sextants and octants had issued from Ramsden's workshop. He received the Copley medal from the Royal Society in 1795 in recognition of the importance of his various inventions. He died November 5, 1800, at Brighton.

RAMSEY, a market town and seaport, England, on the north-east coast of the Isle of Man, on a spacious bay of its name, 17 miles N.N.E. of Douglas. It has wide streets lined with fine houses; there are numerous places of worship, a court-house, an elegant iron pier, forming a delightful promenade, &c. It is a favourite resort of tourists and pleasure-seekers, and has regular steam communication with Liverpool. Pop. (1881), 4025.

RAMSGATE, a seaport and market-town of England, in the county of Kent, 67 miles east by south of London, with which it is connected by railway. The older parts occupy a natural hollow or valley in the chalk cliffs that line this part of the coast, while the newer portions occupy the higher ground on either side. Many of the houses are very handsome, some being arranged in streets, terraces, or crescents, while others are detached villas. The places of recreation and resort comprise a theatre, several libraries, and baths. It has a parish church in the early English style, with a lofty tower and spire; a fine Roman Catholic church, places of worship for Baptists, Independents, Methodists, &c.; a dispensary, general infirmary, seamen's hospital, and a literary and scientific institution. There is a magnificent hotel, a Gothic structure, with a tower 160 feet high. The harbour is formed by piers, and nearly circular, comprising an area of 48 acres, and including a dry dock and a patent slip for the repair of vessels. The east pier is nearly 3000 feet long, and the west pier 1500 feet, both built of Portland and Purbeck stone and granite; the entrance to the harbour is 240 feet wide. Ship-building and rope-making are carried on; there is some trade in coal and timber, and a considerable fishery. Ramsgate was a member of the cinque ports, and attached to Sandwich; it is now a corporate town with a large added area from St. Lawrence, and also a popular watering-place, to which latter circumstance it chiefly owes its recent rapid advancement. Pop. (1881), 22,683.

RAMUS, Peter, a philosopher of the sixteenth century, was a native of France. He went to Paris about 1523, when he was but eight years old, and became a lackey in the College of Navarre. Such was his strong inclination for learning, that he not only devoted to study all the time he could spare in the day, but also a part of the night. After attending a course of philosophy he was admitted to the degree of M.A., on which occasion he contested the infallibility of Aristotle. His opinions excited violent opposition; his publications were prohibited, and ordered to be burned before the Royal College of Cambray, and he was commanded to abstain from teaching his doctrines in 1543. Having obtained the patronage of the Cardinal De Lorraine, the prohibition of lecturing was withdrawn in 1547, and in 1551 he was appointed royal professor of rhetoric and philosophy at Paris. His spirit of free inquiry ultimately led him to become a Protestant. This change obliged him to flee from Paris, but in 1563 he was restored to his chair. In the massacre of St. Bartholomew's (1572) Ramus was one of the victims. His works, relating to grammar, logic, mathematics, &c., are numerous.

Ramus attempted a reform in science analogous to that effected by Luther and Calvin in religion. His keen perception enabled him to detect the defects of scholasticism and expose its worthlessness. By divesting Aristotle of his cloak of infallibility, he rendered a new philosophy possible, and prepared men's minds for its reception by the introduction of a better method. His doctrines were widely diffused. France, England, and particularly Scotland, were full of Ramists. His logic was introduced into the University of Glasgow by Andrew Melville, and made considerable progress in the German universities.

RANA. See Frog.

RANCÉ, Armand Jean le Bouthillier de, celebrated as the founder of the reformed order of La Trappe, was born at Paris, January 9, 1626, where he was also educated. At the age of thirteen he wrote a Commentary on the Odes of Anacreon, which was afterwards published. After having graduated with distinction at the Sorbonne, he embraced the ecclesiastical profession, and before long was preferred to no fewer than six benefices, which the corrupt practice of the time allowed him to hold simultaneously. Residing at Paris, and in receipt of a large annual income from his several benefices, in addition to a considerable fortune left him by his father, he was unable to withstand the allurements of the capital, and gave himself up to a life of dissipation. In 1657, however, a marked change took place in his character. He ceased to appear at court, and determined to enter the cloisters. He disposed of his estate of Véret, near Tours, applying the proceeds to religious purposes, and demitted all his benefices except the priory of Boulogne and the abbey of La Trappe. Retiring to the latter place in 1664, he began those reforms which have rendered his name famous. (See La Trappe.) He passed thirty-three years in this retirement, during which he wrote a number of works, mostly of an ascetic character. In consequence of his growing infirmities he resigned his charge of the abbey in 1695, and died on October 27, 1700.

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